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HISTORY OF SCIENCE TEACHING
IN ILLINOIS

BY

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A.B. UNIVERSITY OF ILLINOIS
1912

THESIS

Submitted in Partial Fulfillment
of the requirements for the
Degree of

MASTER OF ARTS
IN EDUCATION

IN

THE GRADUATE SCHOOL
OF THE
UNIVERSITY OF ILLINOIS
1922

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UNIVERSITY OF ILLINOIS

THE GRADUATE SCHOOL

July 15, 1922

I HEREBY RECOMMEND THAT THE THESIS PREPARED UNDER MY
SUPERVISION BY Guy Jink Koons

ENTITLED History of Science Teaching in Illinois

BE ACCEPTED AS FULFILLING THIS PART OF THE REQUIREMENTS FOR
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THE HISTORY OF SCIENCE TEACHING IN ILLINOIS

I. INTRODUCTION

The teaching of science has had an interesting and an important place in the development of the school system of Illinois. State Superintendent John F. Brooks in a statement published in 1864 said that the teachers of the state were "in a special manner characterized" by being "active, energetic, vigorous and progressive men." He further said that "No improvement in educational methods has ever been rejected by Illinois Schoolmasters because of selfish jealousy, or a blind attachment to ancient ways. They have been ready at all times to extend a cordial welcome to every new truth that has been proclaimed by the pioneers in educational progress, to encourage and applaud every step in advance."¹ These characteristics of the early educational leaders of the state probably account for the fact that while the development of science instruction in Illinois on the whole reflected nation-wide movements there were times when these movements "went further here than elsewhere."

Beginning with the introduction of astronomy and natural philosophy in the earliest schools, by slow and gradual steps we find chemistry, botany, physiology, physical geography, and general science added and the present courses in scientific subjects finally evolved. In most communities in the state science teach-

1. Brooks, Manual of Instruction, p. 123.

ing began by the teaching of natural philosophy as an advanced subject in a private school or in one of the early free schools.

The sciences were first introduced into the schools of the state because of their interesting and practical nature and not because of any downward pressure exerted by the colleges through their entrance requirements. One finds but little concerning entrance requirements in the early discussions of educational problems of the state. In fact, Illinois, because of its geographical situation and early pioneer conditions, was freer from the restrictions imposed by traditions and college entrance requirements than many of the eastern states. In the descriptions of the early private academies and public high schools it is seldom that mention is made of the fact that these schools prepared their pupils to enter college. Interesting and practical subjects appealed most strongly to the early pioneer settlers of Illinois. In more recent years, however, the colleges and universities, through their entrance requirements, have done much to standardize and improve the high schools of the state.

Previous to the organization of high schools in the more thickly settled communities classes in so-called advanced subjects were taught in the early private or free schools. The natural sciences taught among these advanced subjects became a part of the curriculums of the early high schools after they were established. These high schools were established through local initiative and were in no way encouraged or directed by legislative enactment. The only legal justification for their existence as public schools was a broad interpretation by the State Supreme Court of the Act to Establish and Maintain a System of Free Schools. They held

that a high school education might properly be considered a part of a common school education.¹ The selection of subjects to be taught in the high schools was consequently, up to the year 1889, left entirely to the local authorities. Since 1889 physiology and hygiene have been required by law to be taught in the high schools of the state. The natural sciences because of their strong practical appeal naturally constituted an important part of the work of the early high schools.

At first there was little science instruction in the elementary schools. The seven studies prescribed by law to be taught in the common schools were spelling, reading, writing, arithmetic, grammar, geography, and United States history. In the early schools but little was attempted beyond the subjects prescribed by law. In Chicago and some of the larger centers object lessons were introduced with good results. Much elementary science instruction was secured through these object lessons. As a result of an increased interest in the natural sciences which was nation-wide the passage of a law was secured in 1872 which required the elements of the natural sciences to be taught in the common schools of the state. The results obtained from the law were not wholly satisfactory. The sudden introduction of several new branches of study and the lack of teachers prepared to teach them probably account for the lack of permanent results from the law. Because of the strong opposition developed the State Legislature in 1874 amended the law in such a way as to practically nullify its effects. The natural science instruction and object

1. Richards vs. Raymond, 92 Ill. 612.

lessons gradually came to be organized under the name of nature study, and, as such, elementary science instruction has largely been carried on up to the present time. In recent years there has been a tendency to teach science facts in the upper elementary grades and in the lower years of the high school as general science. In some places it is simply designated as science and in others as elementary science.

II. EARLY DEVELOPMENT

Science teaching began early in the schools of Illinois. However, it is difficult to determine just where and when the first science instruction was given because of the scarcity of records concerning the early schools.

The first mention of science instruction was found in the course of this thesis investigation in Reynolds' history of "My Own Times." He says, "In the school near my father's, the teacher was unable to instruct any of his students in the higher branches of the mathematics, or the sciences, and I made arrangements, with the consent of my father, that I should attend during the winter of 1806 and 1807, a good school, taught by a competent teacher. This school was situated a few miles north-east of the present city of Bellville, on the land of the present Mr. Schrearder. I have often examined, with deep feeling, the tumuli of earth where this schoolhouse once stood. I revere and respect the site with the same feeling as the Jews in ancient times did the city of Jerusalem. At this seminary I studied land-surveying and navigation. I attended also to reading, spelling and writing. My father procured me a surveyor's compass, and I learned both the theory and practice of surveying. My compass and mathematical books I retain to this day. I studied various branches of mathematics, and the sciences, until I calculated an almanac, but it never was printed."¹ The extract quoted above does not make

1. Reynolds' My Own Times, p. 59.

clear just what branches of science were studied by Governor Reynolds in this early school. It is probable that he here refers to surveying and navigation as the term science was given a broad meaning in the early days.

Astronomy is the first science of which a definite record was found as being offered in an early Illinois school. In the Western Intelligencer of August 28, 1816, Benjamin H. Sturges advertises that he has opened a school in Prairie de Rocher and proposes to teach "the most useful branches of English education, viz. Writing, Reading and common Arithmetic" and also in addition to these, English grammar, geography, surveying, astronomy, and the Latin and Greek languages.¹ The advertisement here referred to is evidence that Mr. Sturges really opened the school but apparently there is no record available showing that the subjects that he proposed in the advertisement to teach were really taught.

Natural philosophy was the first science taught in many communities in the state. This subject as usually taught was a sort of a general survey of the field of the physical sciences. The first definite reference to the teaching of natural philosophy was found in the Illinois Intelligencer in an advertisement by Joseph Cross dated December 9, 1818. "Mr. Cross respectfully informs the citizens of Kaskaskia and its vicinage, that he intends, should sufficient patronage be afforded, to open a SCHOOL in this town, for the instruction of youth, in Orthography, Orthoepey, Reading, Writing, English Grammar, Arithmetic, and Elocution. Scholars who graduate in these branches of tuition, will be instructed in the rudiments of History, Geography, Natural Philosophy, and Mathe-

1. Western Intelligencer, August 28, 1816.

matics."¹ The files of the Illinois Intelligencer show that Mr. Cross rented a house from Mrs. Carey, south of the church in Kaskaskia, and began his school about the middle of January, 1819. No record, however, was found which shows conclusively that all of the subjects mentioned in the advertisement were actually taught in the school.

The Rev. J. M. Peck exerted an important influence on the early educational developments of the state. To him is entitled the credit for establishing the first school in the state to be called a high school. In 1826 he visited the eastern states to solicit funds to be used for the establishment of a school in Illinois. While his chief mission was to confer with the authorities of the Baptist church in the eastern states he evidently investigated the high schools then but recently established in Boston and in New York. On his return he delivered a lecture in the State House in Vandalia in which he explained "the mode of education practiced in Boston, the high schools in New York, and many public and private institutions" and showed how they might be adapted to the "circumstances in Illinois."² Early in 1827 he established at Rock Springs in St. Clair County a school under the name of the Rock Spring Theological and High School. Two professors were selected for the school: one of Christian Theology, the other of mathematics and natural philosophy. The latter was to be "Principal of the High School Department."³ It is interesting to note in this connection the important place accorded to natural philosophy in the first

1. Illinois Intelligencer, Jan. 13, 1819.

2. Ibid., Dec. 16, 1826.

3. Ibid., March 24, 1827.

organization of the school.

Gradually other branches of science were added to those already taught and some of the private schools and colleges provided apparatus to be used in illustrating natural philosophy and chemistry. The Hillsborough Boarding School, located at Hillsborough, advertised in the Illinois Intelligencer, January 2, 1830, that a school would soon be opened in that town for females.¹ Natural philosophy and astronomy were among the subjects to be taught in proposed school. Illinois College, located at Jacksonville, Illinois, reported in 1832 that a philosophical apparatus worth from \$600 to \$800 had been procured.² The Vandalia Academy and Free School opened July 31, 1837, with an attendance of over one hundred pupils. Announcement was made that the school would soon be supplied with chemical and philosophical apparatus. Among the subjects mentioned as being taught were natural philosophy, chemistry, botany, and astronomy. This was the first record found of the teaching of chemistry or botany.³ The Hillsborough Academy announced, September 14, 1837, that it would soon be provided with chemical and philosophical apparatus. As in the case of the Vandalia Academy and Free School natural philosophy, astronomy, chemistry, and botany were mentioned among the subjects offered. The Young Ladies Academy of the Visitation, located at Kaskaskia, in an advertisement in the Illinois State Register, November 24, 1837, announced that among the subjects taught in that school were philosophy, chemistry, and astronomy.⁴

1. Illinois Intelligencer, Jan. 2, 1830.

2. American Journal of Education, Vol. XXVII, p. 336.

3. State Register, Sept. 15, 1837.

4. Ibid., Nov. 24, 1837.

The meager records of the Illinois schools of the first half of the ~~seventeenth~~^{nineteenth} century indicate that no particular emphasis was given to scientific subjects. The work was largely textbook work and taught in much the same way as the other subjects taught at that time. A very few schools were provided with apparatus to be used in illustrating the work as presented in the text books.

III. SCIENCE INSTRUCTION IN THE GRADES

There was but little science teaching in the early elementary public schools of the state. In most cases the work in these schools was limited to the seven subjects prescribed by law: spelling, reading, writing, arithmetic, grammar, geography, and United States history. From time to time many suggestions were made recommending that the elements of the natural sciences should be made a part of the work of the common schools. Ninian W. Edwards, the first State Superintendent of Public Instruction, stated in his first report that the teachers should have a "practical education, in which should be included not only what is commonly embraced in the common school course, but a practical knowledge of the sciences in their application to the ordinary pursuits of life!" The State Superintendent in his report for 1867-1868 presents with his approval a course of science instruction prepared for the schools of Aurora.¹ This course suggests work on the human body, animals and plants for the primary, intermediate, and high school departments. Particular attention is called to the fact that in the primary grades the exercises are short and "full of vivacity." There is no attempt in the primary department to teach science as science.

Object lessons were early introduced into the Chicago schools and also in some of the larger city schools of the state.

1. State Superintendent's Report, 1867-68, p. 387.

In 1859 according to the report of the Superintendent of the Chicago Schools many of the primary teachers had already introduced "this class of exercises very successfully into their course of instruction."¹ In his opinion "no form of instruction is better adapted to the Primary room, than that which is usually denominated 'object lessons'. These lessons admit of endless variety in their application to the objects of common life, and furnish the happiest and most certain means of imparting useful knowledge. They educate the perceptive faculties of the pupil, develop his common sense, cultivate habits of careful observation and reflection, and give a more ready command of language than can be acquired by any other means." About this time object lessons under the name of the "Oswego Plan" were discussed widely at educational meetings and in the school journals. We find much time given to such a discussion at a meeting of the National Educational Association held at Chicago in 1863, and at a meeting of the State Teachers' Association held at Bloomington. Object lessons found place in a large number of the elementary schools of the state.

In some cases too much emphasis was placed on the method of object teaching and it later came somewhat into disfavor. The Superintendent of the Chicago Schools in his report in 1877 says: "It is admitted that undue prominence has been given to object teaching, and that much of it has been objectless, but the remedy lies not in its entire exclusion, but in its subordination, and in its proper presentation. Much of the disfavor into which object teaching has fallen has grown out of too rigid adherence to the

1. Fifth Chicago Report, p. 28.

'science phase' of instruction. Too little has been thought of the 'art phase'.¹

The Law of 1872 providing for instruction in the elements of the natural sciences in the common schools was a radical and sudden departure from prevailing practice at that time. It was a result of the wave of increased interest in the natural sciences which about that time was sweeping over the country. Because of the sudden and great changes made in the course of study by this law before the state could adjust itself to the new conditions strong opposition led to its amendment.

"Large and substantial advantages" were anticipated from the Law. The teachers were required to pass an examination in the natural sciences before receiving a license to teach. The Law was passed in April and the teachers must pass a satisfactory examination in time to secure a license to teach before the schools opened in the autumn. The immediate effect on the teachers of the state was at least interesting. State Superintendent Bateman says the effect was "almost like the breath of the Lord upon the dry bones in the valley of vision. - - - And never before has such a spectacle been presented to the people of Illinois. From the time the new law was fairly promulgated in April last, till the schools opened in the autumn, the whole state became as it were one great camp of instruction. Vacation plans were everywhere cheerfully given up, and through all the unprecedentedly intense and protracted dog-day heats of the past summer, great numbers of teachers in every part of the state were assiduously engaged in preparing

1. Twenty-third Chicago Report, p. 58.

themselves for examination in the elements of the Natural Sciences.

- - - The common school elements of society, so to speak, were profoundly stirred, everywhere, and a free-school revival, of extraordinary extent and power, was inaugurated."¹ In a circular sent out by the State Superintendent it was recommended that the new studies be taught "by the method of oral lessons, instead of recitations from text-books."² It was his opinion that if the teaching of the natural sciences was to "fall into the old ways" of merely memorizing and reciting daily "so many lines or pages of a book," "the law might as well be repealed, for it will enhance the very evils which have so long benumbed and stupefied the schools."

The new law was such a radical step that it called forth much discussion. Very decided opposition developed to it. Supt. John H. Black of Adams County found it difficult to see what advantage would be derived "from the introduction of the natural sciences."³ "It is evident that in most cases that time given to the sciences must be taken from the study of that which is of much greater practical importance to the pupils." He reported the immediate effect of the law was to produce a scarcity of teachers. Supt. John P. Richmond of Brown County reported that, "If the sentiment of the people as at present constituted, is to be considered as conclusive, the introduction of the sciences into the schools is uncalled for and unnecessary."⁴ Supt. William T. Adams probably

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1. State Superintendent's Report, 1871-72, p. 29.
 2. Ibid., p. 82.
 3. Ibid., p. 236.
 4. Ibid., p. 238.

with some justification reported that it was "too much at once."¹ Supt. Mrs. P. A. Taylor of Alexander County reported that with two or three exceptions the teaching of natural sciences was confined to the high school of Cairo. She believed the law "beneficial only as it raises the standard of teachers."²

Many county superintendents gave favorable reports. Supt J. E. Millard of Carroll County found the action of the legislature in raising the standard of qualifications for teachers was "pretty generally approved."³ He thought that it would have been wiser to discriminate "more than it does between the requirements for first and second grade certificates." Supt. T. R. Leal of Champaign County reports that "for a time some excitement prevailed on account of the addition of Physiology and the Natural Sciences to the course of study in our common schools. Many people thought the new studies useless, and that the plan was devised to raise teachers' wages and benefit booksellers. Many teachers thought the requirements too high and calculated to drive them from their employment." Time, however, brought about changes in the sentiment of the public and the teachers. Supt. Leal finds later that "Besides the new thoughts and ideas thus obtained by the teachers, a marked improvement is manifested in the methods of teaching the 'old branches'. It has infused new life into our school system. Teachers prepare themselves more thoroughly for their work, and the people begin to see that on Botany and Zoology rests nearly all the material wealth of the State." ⁴ Supt. A. J. Mapes of

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1. State Superintendent's Report, 1871-72, p. 240.
 2. Ibid., p. 264.
 3. Ibid., p. 240.
 4. Ibid., p. 240.

Edgar County found that it struck from their roll of teachers "many that were drones in the society of teachers" and that it "tended to improve and better qualify" those still engaged in teaching.¹ Supt. H. S. Comstock of Henry County found "incompetent teachers abandoning the profession."² Supt. Theodore Steyer of Pope County reports that the changes made by the law were "generally looked upon as an imposition against the people, and in favor of the teachers' higher pay. Since our schools have been commenced, and wherever the sciences have been introduced, the people have fast changed in favor of the new law."³

The strength of the sentiment against the law, however, was so great that at the next session of the State Legislature the law was amended in such a way as to practically nullify its effects. The amended law provided for two grades of county certificates, first and second. Examinations in physiology and the laws of health and the natural sciences were required for the first grade. The subjects required for the second grade were orthography, reading in English, penmanship, arithmetic, English grammar, modern geography, and the history of the United States. Since it had been held that the subjects required by law to be taught in the schools were the ones named in the requirements for the lowest grade of teachers' certificates, the amendment withdrew the natural sciences and physiology from the list of subjects required by law to be taught in the common schools. Since teachers could teach with either first or second grade certificates the majority would naturally secure

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1. State Superintendent's Report, 1871-72, p. 263.
 2. Ibid., p. 271.
 3. Ibid., p. 286

only the second grade which was no advance over requirements in effect previous to the passage of the law of 1872. Hence, the amendment practically nullified the effects of the former act.

Physiology continued to be taught in many elementary schools; but its teaching was not general. A law was passed in 1889 requiring that "all pupils of suitable age in schools of Illinois, supported by public money or under state control" be taught "physiology and hygiene, with special reference to the effects of alcoholic beverages, stimulants and narcotics on the human system."¹ The law made physiology and hygiene one of the subjects required in the examination for all grades of certificates to teach. This was the first law in Illinois specifically requiring that a particular subject should be taught in the schools. It had previously been held that the subjects required for the lowest grade of teachers' certificates were the subjects required by law to be taught in the schools.

It was felt by temperance advocates, particularly the Women's Christian Temperance Union, that the law was not sufficiently effective. Consequently, through their influence a new law was enacted June 9, 1897, which more definitely regulated the teaching of physiology and hygiene.² It was prescribed that the nature and effects of alcoholic drinks and other narcotics on the human system should be taught in connection with the other divisions of physiology and hygiene as "thoroughly as are other branches in all schools under state control, or supported wholly or in part by public money." It must be taught in all grades to and including the first year of the high school for at least ten weeks each year.

1. Appendix, p. 43.

2. Ibid., p. 44.

It was prescribed that for the grades at least one-fifth of the text-book should be given to the nature and effects of alcohol and narcotics on the human system. This law is rather remarkable as it is the first law specifying in just what grades a subject shall be taught, the length of time, what subject matter shall be taught, and the proportion of the text books to be given to certain subjects. It had previously been generally held by educational authorities that such matters were not proper subjects for legislative enactment but belonged to the local school authorities for determination. The law is still in force in the state.

The object lessons of the early days gradually gave way to a better organized course of instruction for the elementary schools generally known as nature study. The Cook County Normal School was an important center of influence in the development of the nature study idea. Col. F. W. Parker and W. S. Jackman were the leading figures in the movement in the Cook County Normal School.

Illinois and the nation owe a great debt to Col. F. W. Parker, the educational leader and reformer, for his work in improving the work of the elementary schools. It was his aim to make the schools "less artificial and conventional" by providing an enriched school curriculum which would appeal more strongly to the interests of the boys and girls. "Geography and nature study were given commanding places in the scheme of instruction."¹ It was his theory that "Nature refuses to be viewed in bits and rags. A leaf or a twig would not do; the child must have the whole tree, with the land around, or still better the forest. Field excursions with

1. Monroe's Cyclopedia of Education.

their wealth of observation were early introduced. Woods, swamps, and the lake shore were investigated with pencil or brush in hand." Col. Parker furnished the inspiration and an impetus which later led to the organized nature study which in many places became an important and integral part of the elementary school curriculum.

The work, particularly along the lines of nature study, began by Col. Parker was continued and improved by Wilbur S. Jackman. He was brought to the Cook County Normal School as a member of the faculty in 1889 by Col. Parker. Accepting Col. Parker's point of view, he was able to organize the nature study materials in such a way that they could be more effectively used by the regular class room teachers.

"Failures in nature study, failures that were, however, prophecies, were the rule, until Wilbur S. Jackman in 1889, undertook to grapple with the problem. The idea of thorough, exhaustive work was abandoned. The phenomena of the 'rolling year' were taken as the general guides; the child was brought into living contact with nature; the subjects were adapted to different stages of child growth; art and nature were correlated." The type of nature study work developed by W. S. Jackman was adopted for general use in the elementary schools of Chicago and the surrounding territory. It also had an important influence on the character of the work carried on in the rest of the state.

The normal schools of the state have done much to promote the cause of science instruction in the grades. The Illinois State University at Normal, Illinois, has made special efforts to emphasize the importance of the work and through courses offered there, and articles written by teachers in the university for school publi-

cations has exerted a strong influence on elementary science instruction throughout the state. The two most important centers of influence in the field of elementary school science work have been Cook County Normal School, which necessarily has influenced most the work in Chicago, and Cook County, and the Illinois State Normal University which has exerted a similar influence on much of the rest of the state.

In spite of all that has been done to promote science teaching in the elementary schools the results have not been wholly satisfactory. There is at present no great amount of enthusiasm for science instruction among the elementary school teachers. In fact, in a large number of schools in the state no provision whatever is made for elementary science instruction other than the physiology and hygiene required by law. This state of affairs may be accounted for by the crowded condition of the elementary school curriculum and the lack of preparation on the part of the teachers. Elementary science instruction will probably come back into its own when our elementary curriculum is reorganized and better teacher preparation is required.

IV

III. SCIENCE TEACHING IN THE PUBLIC SECONDARY SCHOOLS PRIOR TO 1892.

The development of science instruction in the secondary schools forms an interesting chapter in the history of science teaching in the state. In the most of the larger centers of population in the state some advanced subjects including some of the sciences were taught in connection with the upper grades or classes. When the high schools were separately organized these scientific subjects were taken over by them and made a part of their curriculums. At first these courses were largely informational and taught in much the same way as the other subjects taught in the high schools. Some of the larger secondary schools were supplied with the philosophical and chemical apparatus and procured cabinet collections of specimens for illustrative purposes. Following the leadership of the Illinois State Normal University, many of them began regular laboratory work in the late '70's. However, such work did not come to be generally followed until after the report of the Committee of Ten was made.

The science courses offered in the first free high schools were very similar to those offered in the early academies which have already been discussed. In a preceding chapter it was noted that natural philosophy, astronomy, chemistry, and botany were the sciences most often mentioned as being taught in the early academies. In the early reports it is interesting to note that the scientific courses offered in the early academies and high schools differ but

but little at least in name from the courses offered in the early colleges.

There was great uniformity in the arrangement of the curriculums in the early high schools. Consequently, a discussion of the curriculums of one high school may serve as a type. The Chicago high schools may well serve to illustrate development of science instruction in high schools. The fact that complete sets of the Chicago School Reports are available makes it possible to trace rather carefully the changes taking place in the science instruction from the establishment of the first Chicago High School in 1856 to the present time. The changes taking place there are to some considerable extent typical of changes taking place in the science work of other high schools of the state.

The first high school in Chicago was organized in the year 1856 with three departments: Teachers', English High, and Classical. Two years of work were prescribed for the Teachers' curriculum; three for the English High; and three for the Classical. A combination of courses was arranged whereby a pupil could complete both the English High and the Classical curriculums in four years.¹ Science was given an important place in the high school from its beginning. The arrangement of subjects by terms and years is not shown in the first printed report. However, the following arrangement of subjects according to departments with names of text-books used helps in getting an idea of the place accorded to scientific subjects in the organization of the school:

1. Third Chicago School Report, p. 28.

ENGLISH HIGH DEPARTMENT

1. Preparatory studies reviewed, using the text books authorized in the Grammar Schools.
- ✓ 2. Warren's Physical Geography.
3. Weber's Universal History.
- ✓ 4. Ancient Geography.
5. Greenleaf's National Arithmetic.
6. Greenleaf's Algebra.
7. Davies's Legendre.
8. Plane & Spherical Trigonometry.
9. Mensuration.
10. Gillespie's Surveying.
11. Navigation.
- ✓ 12. Crittenden's Elementary Bookkeeping.
- ✓ 13. Botany.
- ✓ 14. Burritt's Geography of the Heavens.
15. Higher Astronomy.
- ✓ 16. Cutter's Physiology.
- ✓ 17. Tate's Natural Philosophy.
- ✓ 18. Youman's Chemistry.
- ✓ 19. Geology and Mineralogy.
20. Rhetoric.
21. Logic.
22. Wayland's Political Economy.
23. Principles of Government.
24. Wayland's Mental Philosophy.
25. Wayland's Moral Science.
26. Etymology.

- 27. English Literature.
- 28. Hillard's First Class Reader.
- 29. Drawing.
- 30. Vocal Music.
- 31. German or French.

Woodbury's German series.

Fasquelle's French Course.

- 32. Recitations and Compositions.

NORMAL DEPARTMENT

Nos. 1, 2, 3, 4, 5, 6, 7, 12, 13, 14, 16, 17,
18, 19, 20, 23, 24, 25, 26, 27, 28, 29, 30, 32.

Theory and Practice of Teaching.

CLASSICAL DEPARTMENT

Nos. 1, 2, 3, 4, 5, 6, 7, 14, 16, 17, 26, 28, 30, 32.

Andrews's and Zumpt's Latin Grammars.

Harkness's Arnold's First and Second Latin Lessons.

Arnold's Latin Prose Composition.

Andrews's Caesar.

Johnson's Cicero.

Bowen's Virgil.

Andrews's Latin Lexicon.

Anthon's Classical Dictionary.

Crosby's Greek Lessons.

Arnold's Greek Prose Composition.

Felton's Greek Reader.

Boise's Xenophon's Anabasis.

Owen's Homer's Iliad.

Liddell and Scott's Greek Lexicon.

It is evident from the list of subjects given that those in authority when the first Chicago High School was organized believed that a knowledge of the sciences formed an important part of a high school education. Scientific subjects made up about thirty per cent of the work prescribed for those who were preparing to teach. They were expected in their two years of preparation to study physical geography, botany, geography of the heavens, physiology, natural philosophy, chemistry, geology, and mineralogy. Science constituted approximately twenty per cent of the work of the pupils in the English High Department. They were required to take all of the sciences prescribed for the Normal Department and in addition higher astronomy. The pupils in the Classical Department were required to study scientific subjects to the extent of about fifteen per cent of their work. They were required to study physical geography of the heavens, physiology, and natural philosophy. The science requirements of these first curriculums of the Chicago High School are higher than the science requirements of most of the high schools of to-day.

The first science courses were largely text book courses. However, from the very beginning there was felt by the authorities a need for apparatus and other supplies to be used for illustrative purposes in connection with the work in the sciences. At the end of the first year following the organization of the High School, Superintendent Wells in his annual report says: "the most pressing want of the high school that still remains, is a supply of suitable

apparatus for illustration and experiment in the various departments of science."¹ He further states it as his opinion that it is "impossible to give satisfactory instruction in such branches as Chemistry, Natural Philosophy, and Surveying, without the aid of apparatus." We are led to infer from the reports that in most cases the apparatus was to be used by the teacher for illustrative purposes and seldom by the individual pupils. In fact, in a later report we learn that in a large high school "not a hundred miles from Chicago" a placard was placed in the science room which contained the inscription "Pupils must not handle the apparatus."² The high school here referred to is no doubt typical of many of the high schools of that period.

In the Sixth Annual Report we find the first outline giving arrangement of subjects by terms and years. The outline is that arranged for the Normal Department.³

NORMAL DEPARTMENT

Outline of the Course

	First Term	Second Term	Third Term
FIRST	Arithmetic		Physical Geog-
Year	Political Geog- raphy and map drawing	Same as First Term	raphy Botany Natural Philos- ophy
	Grammar		Geometry
	Algebra		
Second	Natural Philos- ophy	Hist. of U.S. and outlines of General History	Arithmetic, $\frac{1}{2}$ term geography
Year	Physiology Bookkeeping, $\frac{1}{2}$ term Chemistry	Rhetoric Astronomy English Litera- ture	Grammar Mental Philos- ophy English Litera- ture
	Constitution of U. S. and Prin- ciples of Gov't:		

1.

2. Forty-first Chicago Report, p.93.

3. Sixth Chicago Report, p. 87.

Reading, through the entire course.

Composition, through the entire course.

Practice of teaching, through the entire course.

Singing, through the entire course, one lesson per week.

Drawing, through last four terms, two lessons per week.

Theory of Teaching, last two terms, two lessons per week.

In this outline the work in science continues to make up about the same proportion of the work of the Normal Department as it did at the first organization of the school, about thirty per cent. In fact, in the early years of the High School history the arrangement of the subjects in the different departments changed but little. It is interesting to note that in the Normal Department the science work is not evenly distributed throughout the different terms. No science was taught in the first and second terms of the first year or in the third term of the second year. Three sciences - physical geography, botany, and natural philosophy, appear in the work outlined for the ~~third~~ term of the first year. Three sciences, natural philosophy, physiology, and chemistry, were taught in the first term of the second year's work. Astronomy was the only science taught in the second term of the second year's work. Apparently not much attention had been given in planning the outline of the work for the Normal Department to the matter of distribution, position, and sequence of the different branches of science.

For several years the subjects prescribed for the different departments remained the same. Higher astronomy was the first subject to be dropped from the prescribed list. A little later

navigation and mensuration were dropped. No explanation appears in the school reports as to just why these subjects were dropped.

The name of the English High Department was changed to the General Department in 1860. The report for that year contains an outline giving the arrangement of courses in all three of the departments of the school - the General, the Classical, and the Normal. The outline for the Normal Department has already been given as it was printed in an earlier report. These outlines are of special interest because of the fact that they were probably the first outlines published in the state showing the arrangement of the work of a high school.

HIGH SCHOOL

Synopsis of the General Course

Year	First Term	Second Term	Third Term
I	: Algebra	: Algebra	: Arithmetic
	: German or Latin	: German or Latin	: German or Latin
	: Descriptive Geogra- phy	: English Grammar	: Physical Geography
	: Algebra	: Geometry	: Geometry
II	: German or Latin	: German or Latin	: German or Latin
	: Universal History	: Universal History	: Universal History
	: Geometry	: Trigonometry	: Mensuration, Navi- gation & Surveying
	: German, Latin, or French	: German, Latin, or French	: German, Latin, or French
III	: Physiology	: Natural Philosophy	: Natural Philosophy
	: Rhetoric	: English Literature	: English Literature
	: Astronomy	: Chemistry	: Geology and Miner- alogy
	: German, Latin, or French	: German, Latin, or French	: German, Latin, or French
IV	: Intellectual Phil- osophy	: Logic	: Moral Science
	: Constitution of U.S. and Bookkeeping	: Political Economy	: Political Economy

Reading, during the first and second years.

Drawing, during the second, third, and fourth years.

Composition and Declamation, through entire course.¹

Synopsis of the Classical Course

Year	First Term	Second Term	Third Term
I	: Algebra	: Algebra	: Arithmetic
	: Harkness' First	: Harkness' First	: Latin Reader
	: Latin Book	: Latin Book	
	: Descriptive Geogra-	: English Grammar	: Physical Geography
	: phy	: and Analysis	
II	: Algebra	: Geometry	: Geometry
	: Latin Reader	: Caesar	: Caesar
	: Universal History	: Universal History	: Universal History
			: Botany
III	: Greek	: Greek	: Greek, Anabasis
	: Caesar or Cicero	: Cicero	: Cicero
	: Physiology	: Natural Philosophy	: Natural Philosophy
IV	: Greek, Anabasis	: Greek	: Greek, Iliad
	: Virgil, Eclogues	: Virgil, Aeneid and	: Virgil, Aeneid
	: Cicero	: Georgics	: Review of Latin
	: Latin Prose	: Latin Prose	

Reading, during the first and second years.

Drawing, during the second, third, and fourth years.

Composition and Declamation, during the entire course.

Classical Antiquities, Military Affairs, during the second year. Classical Antiquities, Civil Affairs, during the third year. Classical Antiquities, Mythology, during the fourth year.²

1. Seventh Chicago Report, p. 130.

2. Ibid., p. 131.

It is interesting to note the position and sequence of the sciences in these early high school curriculums. The distribution of the sciences throughout the different terms is better than the distribution found in the curriculum of the Normal Department. Physical geography was the first science taught and is found in the third term of the first year in both the General and the Classical curriculums. Botany is the second science found in the outline and appears in the third term of the second year in both curriculums. Physiology is found in the first term of the third year in both curriculums. Two terms were given to natural philosophy, the second and third terms of the third year in both the General and the Classical curriculums. Astronomy is found in the first term of the fourth year of the General curriculum. Chemistry is found in the second term of the fourth year of the General curriculum. Geology and mineralogy make up a part of the work of the third term of the fourth year of the General curriculum. The science courses as outlined were all arranged for one term only except in the case of natural philosophy which was given for two terms. It is evident that no exhaustive study of any of the sciences could be made in the time allotted to them in the printed outlines. The work was necessarily of the text book, memoriter kind which later gave rise to the popular series of science text-books known as the "ten weeks" courses written by J. Dorman Steele and which exerted a strong influence in perpetuating this kind of work in the high schools of the state and of the entire nation.

Three years after the organization of the High School, the Superintendent reports " a valuable Philosophical and Chemical Apparatus recently procured at an expense of one thousand dol-

lars."¹ The money needed to secure this apparatus was donated by the parents of the high school pupils and by other citizens who were interested in the welfare of the school. A large oxy-hydrogen microscope was donated by Samuel Hoard. It was Superintendent Wells' opinion that by these donations "the greatest obstacle to the success of the school that has hitherto existed" was removed. The Principal of the High School reports that "the apparatus is now in daily use in the school."

It soon became evident to the high school authorities that the time allotted to the sciences was inadequate. In 1860 Principal Dupee recommended an increase in the amount of time given to the natural sciences in order as he says "to make the study of this part of the course much more comprehensive and valuable."

The Committee on Natural Sciences appointed by the Board of Education reported in 1868 that they had attended the public examinations of the pupils in the natural sciences and they found that the pupils in geology "have acquired a pretty full knowledge of the main principles, being able to describe with correctness, the different geological formations, and the fossil remains which characterize them."² In their opinion the advantages of the study of physiology "depend very much upon the selection of topics made by the author in the text book." They were well pleased with the botany examination and report that "this beautiful study has received more than its usual share of attention, and the Committee was highly gratified with the proficiency of the pupils."

1. Fifth Chicago Report, p. 44.

2. Fourteenth Chicago Report, p. 17.

The Committee on Natural Sciences that investigated the work in 1873 was not particularly well pleased with conditions as it found them.¹ Its report shows, too, a growing recognition of the ineffectiveness of the text book method of teaching the sciences. The Committee reported that the examination "showed that the classes had been carefully instructed in the text book" in botany, "but that they had done little in the study of living plants." It urged that the pupils in this subject make collections and study the plants themselves. In its opinion, "the knowledge derived from the text book alone is of little worth beyond enabling them to obtain rank in class or to pass a verbal examination." The Committee reported the examination in physiology "a lamentable failure, discreditable alike to teacher and class."

More attention came gradually to be paid to the sequence of the different branches of science as well as to a fuller and more extended treatment of those taught. In 1872 the different subjects were all arranged in one curriculum. About four and one-half years science instruction was offered. Physical geography and physiology made up the science work of the first year; natural history and botany, the work of the second; physics, astronomy, and mechanics, the work of the third; chemistry and geology, the work of the fourth. This sequence bears a close resemblance to that found in many present day high school curriculums.

In 1874 the Superintendent reports that "the addition of a working laboratory to the department of chemistry has materially

1. Eighteenth Chicago Report, p. 73.

advanced the value of that department, and has certainly increased the interest felt in the department."¹

Attention is called to the fact by the superintendent in his report of 1875 that "more prominence has been given the sciences and their arrangement in the course is now such, that each study taken up, will aid the pupil in mastering those that succeed it."

The science instruction described continued in the Chicago High Schools much the same until about 1892, when modern laboratory methods came to be generally introduced. The Harvard list of Physics experiments was published in 1887 and influenced greatly physics instruction in eastern high schools and to a somewhat lesser extent in the mid-west. This and other attempts to unify and standardize high school instruction finally led to the Report of the Committee of Ten which proved to be probably the most important influence for the modification of methods of secondary science in the whole history of its development.

The fact that the early public high schools in Illinois were organized as a result of local initiative resulted naturally in a serious lack of uniformity. There was need of some central authority to prescribe and to enforce the observance of certain definite standards. The criticism of W. T. Harris,² expressed in his letter of transmittal of the Report of the Committee of Ten, applied to the high schools of Illinois particularly well.

"It has been agreed," he said, "on all hands that the most defective part of the education in this country is that of the secondary schools. There is wide divergence in the course of

1. Twentieth Chicago Report, p. 81.
2. Report of Committee of Ten, p. 1.

study, and the difference of opinion regarding what constitutes a secondary education works injury not only to the elementary schools by setting up uncertain standards of admission, but also through a want of proper requirements for graduation prevents in thousands of cases the continuance of the course of education of youth in colleges and universities."

Some idea of the great lack of uniformity existing may be obtained from the fact that investigation showed "that total number of subjects taught in these secondary schools was nearly forty, thirteen of which, however, were found only in a few schools; secondly, that many of these subjects were taught for such short periods that little training could be derived from them; and thirdly, that the time allotted to the same subject in different schools varied widely. Even for the older subjects, like Latin and algebra, there appeared to be a wide diversity of practice with regard to the time allotted to them."¹

That science instruction was found to be in a very unsatisfactory condition is indicated in the Committee's Report. "The spirit of the Conferences was distinctly conservative and moderate, although many of the recommendations are of a radical nature. The Conferences which found their tasks the most difficult were the Conferences on Physics, Astronomy, and Chemistry; Natural History; History, Civil Government, and Political Economy; and Geography; and these four conferences make the longest and most elaborate reports, for the reason that these subjects are to-day more imperfectly dealt with in primary and secondary schools than are the

1. Report of Committee of Ten, p. 4.
2. Ibid., p. 13.

subjects of the first five Conferences." The first five Conferences were Latin; Greek; English; Modern Languages, and Mathematics.

The high schools of Illinois were probably in a worse condition than that described in the Report of the Committee of Ten. Regent Peabody of the University of Illinois reported that "the very name (high school) often meant no more than that the school was the highest in the community and that there were many district schools offering better instruction than some that claimed secondary grade."¹ The writer attended and graduated from one of the high schools of this period. It was located in a small town. The high school consisted of three years work, the first of which was given over entirely to the common branches. The sciences studied were physiology, botany, zoology, physics, and chemistry. The text books used, except in the case of botany, were Steele's Ten Weeks Courses in each of the subjects named. Gray's Botany with Manual was the text in that subject. The work in science was largely text book and pursued in much the same way as any other subjects in the curriculum. Occasionally the teacher would perform some experiment before the class for the purpose of demonstration. It was seldom that pupils were permitted to handle the apparatus. The standards required for graduation may be judged from the fact that the writer completed the required amount of work and graduated from this high school after twelve months attendance. There was in the period under discussion a need of some agency to set definite standards for the high schools and to possess sufficient authority to compel their observance.

1. Nevins, History of the University of Illinois, p. 124.

Little did the university of Illinois authorities dream when they first adopted a system of accrediting high schools of the important part such a system was to play in raising the standards and in bringing about uniformity in the work of the high schools.

A plan for accrediting high schools was first adopted by the University of Illinois authorities in 1877. The plan provided "that the faculty may designate as accredited high schools whose pupils shall be admitted to the University upon their certificate of graduation, such high schools as they may find upon examination of their facilities for teaching and methods and course of instruction giving their pupils such preparation as is required for admission to the University."¹ Two kinds of high schools were designated. One kind was called examining high school.² One examining high school was named for each county in the state. The examinations given by these high schools were accepted in lieu of the entrance examination given by the University. The examining high schools were discontinued in 1884. The other kind of high schools was made up of schools whose pupils were admitted without examination. The first high school to be accredited was the Princeton Township High School.³ In 1880 the number of accredited high schools had increased to twenty-two. In 1887 two classes of accredited high schools were distinguished - fully accredited and partially accredited schools.⁴ Pupils from the partially accredited

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1. State Superintendent's Report 86, p. CLII.
 2. Nevins, History of the university of Illinois, p. 88.
 3. Alumni Record, 1913, p. 13.
 4. Nevins, History of the University of Illinois, p. 88.

schools were admitted only to the Colleges of Agriculture, Engineering, and Natural Science. According to President Peabody, the early accrediting system adopted was of little help to the University. He reports that during a period of seven years 156 students had been admitted on high school diplomas and that of that number 118 came from three high schools located "within sight of the towers of the University." In the early days of the accrediting system different members of the University faculty were designated to visit and report on the high schools requesting such inspection. Owing to the fact that definite standards to be required of high schools were not carefully worked out and only a small number of high schools were on the accredited list, it is evident that the University accrediting system was not the potent influence in helping the schools to develop and maintain high standards of efficiency that it afterwards became.

V SCIENCE TEACHING IN THE PUBLIC SECONDARY SCHOOLS SINCE 1892

The period prior to 1892 was characterized by the establishment of the high school as a definite part of the public school system and by a rapid growth in the number of high schools in the state. There was little uniformity as to curriculum arrangement, length of term, preparation of teachers, equipment, or requirements for graduation. There was no central agency with sufficient influence to bring about general uniformity of standards necessary for efficient work. The high schools of this period certainly were not dominated by college entrance requirements. An accrediting system had already been provided by the State University as discussed in the preceding chapter. However, it had not yet become a strong factor in the raising of high school standards.

The Report of the Committee of Ten marks the beginning of definite and uniform standards for high schools. This report was one of the strongest influences in crystallizing sentiment as to just what standards should be required of secondary schools. There was more need of this sort of thing in science instruction probably than in most of the other fields. The Committee recommended four curricula:¹ classical, Latin-scientific, modern languages, and English. Physical geography was recommended for all in the first year; botany or zoology, for the second year in all but the classi-

1. Report of Committee of Ten, p. 46.

cal; the classical offered no science in the third year; the other three recommended astronomy, one-half year, and meteorology, one-half year in the third year; all offered chemistry in the fourth year; Latin-scientific, modern languages, and English offered geology or physiography, one-half year, and anatomy, physiology and hygiene, one-half year in the fourth year. The recommendation of the Committee as to the place for each science was not generally followed. However, the important result of their recommendations was that longer and more thorough courses supplanted the short informational courses which were characteristic of the preceding period. The Committee suggested that, "If every subject studied at all is to be studied thoroughly and consecutively, every subject must receive an adequate time-allotment. If every subject is to provide a substantial mental training it must have a time-allotment sufficient to produce that fruit." Since final selection of subjects was to be made by or on behalf of the individual pupil, "all the subjects between which choice is allowed should be approximately equivalent to each other in seriousness, dignity, and efficacy. Therefore, they should have approximately equal time-allotments."

The recommendations of the Committee did much to bring about the introduction of regular laboratory work in connection with science instruction. Laboratory work had been introduced in connection with science work in the colleges for some time. Some of the larger high schools were making use of it. However, its use among high schools was not widespread.

According to the Committee,¹ "Laboratory subjects should

1. Report of Committee of Ten, p. 50.

have double periods whenever that prolongation is possible. - - - Laboratory work requires more consecutive time than the ordinary period of recitation affords; so that an hour and a half is about the shortest advantageous period for a laboratory exercise." It was recommended, "That in secondary schools physics and chemistry be taught by a combination of laboratory work, text-book, and thorough didactic instruction carried on conjointly, and that at least one-half of the time devoted to these subjects be given to laboratory work." "That laboratory work in physics should be largely of a quantitative character." "That careful note-book records of the laboratory work in both physics and chemistry should be kept by the student at the time of the experiment." "That the laboratory work should have the personal supervision of the teacher at the laboratory desk." "That in the opinion of this Conference it is better to study one subject as well as possible during the whole year than to study two or more superficially during the same time."

The emphasis placed by the Committee of Ten on laboratory work as a vital part of science instruction soon resulted in the reorganization of the science courses in the high schools with more adequate provision for laboratory work. This reorganization was hastened and aided by the action of various accrediting agencies in requiring adequate laboratory facilities as a prerequisite in the accrediting of work in science.

The larger high schools were naturally the first to take up the new method of science instruction. From the Chicago School Report¹ we learn that in 1892, "The West Division High School has

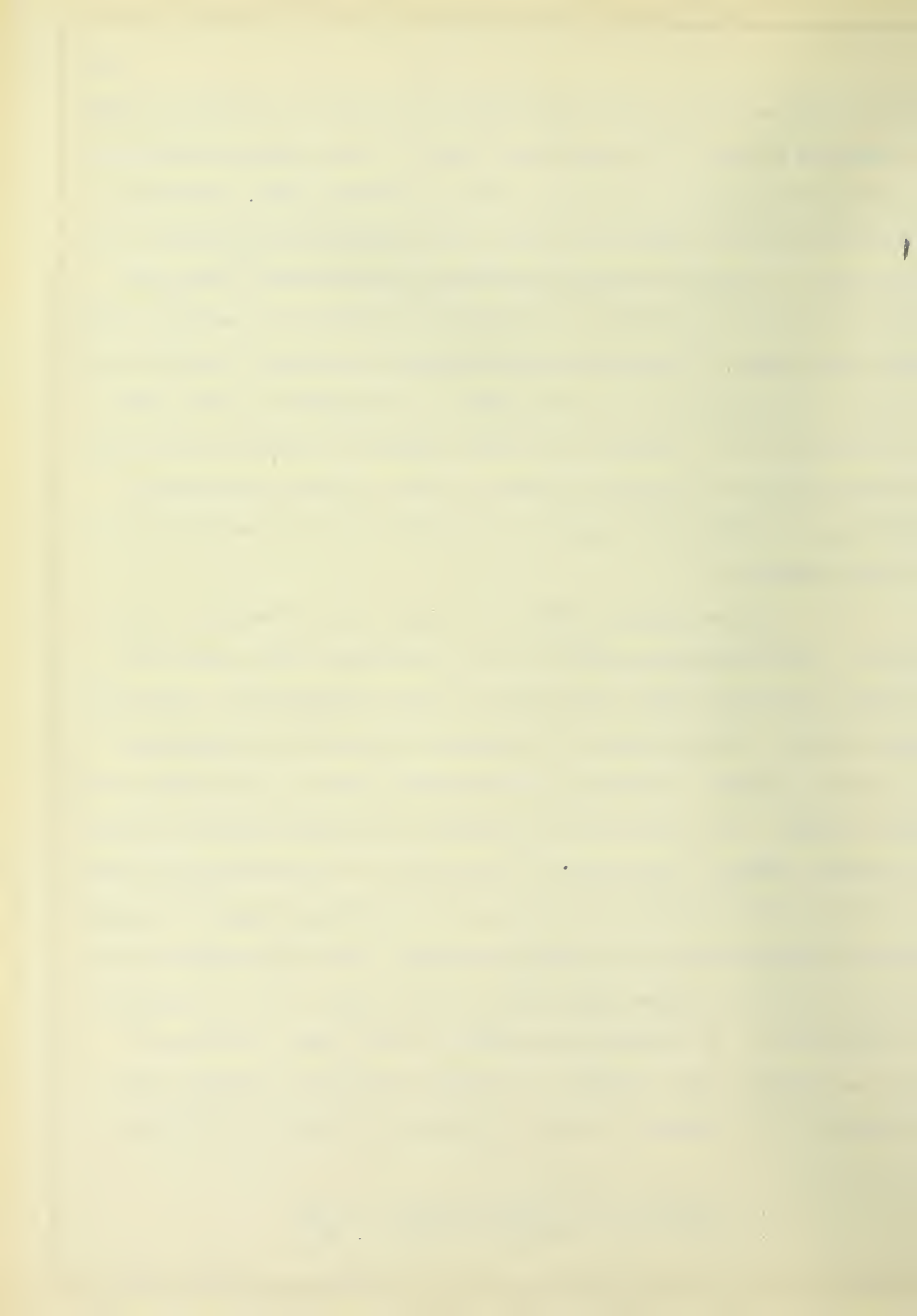
1. Thirty-Eighth Chicago School Report, p. 50.

been fully equipped during the year for practice in physics, chemistry and biology. The North and South Division High Schools are still poorly prepared for any proper laboratory work. There has been an effort to make the study of all sciences as practical as possible. Classes with their teachers have frequently made excursions into the country in their investigations in geology, zoology and botany. The teachers have during the summer vacations secured specimens which have been used for dissection in the study of animal life. Aquariums have been supplied to some of the high schools where the characteristics of water animals are studied. Drawing is very freely used for illustration in the sciences and other studies."

The next year, 1893, the Chicago Superintendent reports that, "The laboratory method of work is adopted; the pupils observe the object, and write notes of their observations, following an outline. The microscope is used and dissection is practiced to a certain extent. Drawings are frequently made to illustrate parts and organs. Written papers are finally presented upon each topic studied, showing the results of the pupils' observations and conclusions."¹ In 1895 we are assured by the Chicago Superintendent that "The days of the old textbook regime, when the teacher with book in hand asked the questions, and the pupil, with no adequate conception of the theme, attempted to answer them, are past."² It is reported that nearly all of the Chicago high schools are supplied with laboratories for the "natural method of teaching

1. Thirty-ninth Chicago Report, p. 62.

2. Forty-first Chicago Report, p. 93.



sciences." It is urged that the "pupil should handle the apparatus and perform the experiments for themselves, that they see with their own eyes, prove by their own manipulations, and therefore understand the laws and principles which the printed page either alone or when aided by experiment wholly conducted by the teacher, does not elucidate."

After definite standards for science instructions have been determined it is necessary that means be provided in order to see that they are generally adopted. Some high schools would, without doubt, promptly accept proposed standards. However, to secure general acceptance some agency must be provided that will furnish a strong motive for meeting such high requirements. The accrediting system of the State University, the North Central Association system of accrediting, and the plan for Recognized Schools of the State Department of Public Instruction have served to secure a general acceptance of high standards for science instruction throughout the state.

The accrediting system of the State University has probably been the most effective influence in raising the standards and increasing the efficiency of the high schools of the state. Attention has already been called to the adoption of the system and its early workings. In the early days the visits and inspections were made by the President of the University or by some member of the faculty. As the number of high schools increased and the work of the University expanded this plan was found to be unsatisfactory. President Draper within a few years after assuming his duties as president reported to the Board of Trustees that,¹ "The time has

1. Eighteenth Report of Trustees, U. of Ill., p.251.

come when it seems imperatively necessary that the University should employ a man whose special duty it shall be to visit high schools with a view to placing them or continuing them, upon the accredited list of the university." He found the work when performed by regular members of the faculty seriously interfered with their regular work and too there was much variety of judgment in passing upon the merits of the different schools applying for inspection. He saw the situation from the high school point of view and somewhat prophetically suggested that such a plan "would have a stimulating and helpful effect upon the high school work throughout the state." The results have fully justified the wisdom of President Draper's plan, and the accrediting system as administered by the High School Visitor has been "a most powerful lever in raising the standards of the work done" in the high schools of the state. Three men have held the position of High School Visitor since the inauguration of the plan in 1896: John Edward McGilvrey, 1896-1899; Stratton D. Brooks, 1899-1902; and H. A. Hollister from 1902 to the present time.

The High School Visitor has adopted the standards proposed by the Committee of Ten and revised by the Committee of Twelve and succeeding committees as the basis of the requirements in the field of science as well as other fields of instruction. The first High School Manual published by the High School Visitor set forth the standards to be met by schools wishing to have their work accredited:¹

1. There must be at least 36 weeks of actual school work in the school year.

1. High School Manual, 1906-1907, p. 18.

2. Four teachers must be employed in the grades below the high school.

3. Two or more teachers must be employed to give full time to the high school work.

4. Recitation periods must be at least forty minutes in length.

5. Teachers must be well prepared for the work they undertake to teach.

6. Text books must be well chosen.

7. Adequate equipment in the way of libraries and laboratories must be provided.

The Manual recognizing the importance of laboratory instruction says: "The laboratory is as essential as any other recitation room and should not be relegated to the cellar or to the attic if this can be avoided. It should be provided with suitable tables and chairs." Definite recommendations as to apparatus and other equipment needed for the different sciences were included. With but little change these recommendations have stood as the standards for accrediting for twenty years. The latest standards in addition to those named above require: That the financial condition of district be satisfactory; consecutive double periods for all unprepared work such as laboratory, shop, drawing.¹ There must be three or more teachers, including superintendent or principal, devoting full teaching time to high school work. Definite outlines and suggestions for the different subjects printed in the High School Manual assist the high schools to keep the work up to the high standards set.

Many of the larger high schools of the state have been influenced by the requirements of the North Central Association of

1. High School Manual, 1920, p. 12.

Colleges and Secondary Schools. Its standards are somewhat higher than those set by the State University. In 1904, when the first list of accredited schools was prepared for the North Central Association, the following standards were applied:

1. Preparation of teachers of academic subjects included graduation from North Central Association college or equivalent.

2. Teachers should teach but five periods per day. All teaching more than six were rejected.

3. Adequate library and laboratory facilities must be provided.

4. Maximum number of pupils per teacher thirty based on enrollment.

5. There must be five teachers exclusive of the superintendent.

In 1922 the North Central Association requirements include:

1. Satisfactory hygienic conditions.

2. Adequate library and laboratories.

3. Fifteen units required for graduation; school year, 36 weeks.

4. Efficiency of instruction, acquired habits of thought and study, general intellectual and moral tone of school are considered as paramount factors.

5. Adequate salaries paid teachers.

6. Teachers of academic subjects graduates of approved colleges, with eleven hours education credits. After September 1, 1924, fifteen hours will be required.

7. Teachers teach not more than six periods daily. Minimum length of period forty minutes exclusive of time of passing of classes.

8. Maximum ratio 25 pupils per teacher based on average attendance. No teacher should have more than 150 student-recitation periods per day.

There has been a gradual change in the nature of the subject matter presented in the high school science courses. In the early days it was largely what was then known as "pure science". In the nineties a strong tendency developed to emphasize the practical applications of scientific principles. All sciences now show both in the text books and in the methods of instruction a strong practical bent. When the laboratory method was first introduced into high schools the courses in many cases were almost reproductions of college courses and were not adapted to pupils of high school age. This was particularly true of physics. However, text books and courses have been reorganized and the material adapted to the needs of pupils of high school age.

The sequence of science courses has not changed greatly in the last twenty years. The prevailing arrangement has been somewhat as follows: first year, physiology and physical geography, one-half year each; second year, zoology and botany, one-half year each; third~~d~~ year, chemistry; fourth year, physics. Recently there has been a decided tendency to substitute general science in the first year instead of physiology and physical geography.

General science came into the curriculum somewhat as a protest against the dry and formal routine into which much of the science work had fallen after the introduction of laboratory methods of instruction. Laboratory work in the hands of a skillful teacher may make the subject matter of science intensely interesting. However, as it is often carried on no permanent results are secured and the work even becomes distasteful to the pupils. To John Calvin Hanna, Principal of the Oak Park Township High School,

is due credit for introducing what was probably the ^N~~first~~ general science course in the state. Mr. Hanna says,¹ "Here and there rebellion arose against this system of science instruction. The writer was one of those rebels and his rebellion was also against the system of confining for a year the attention of the beginner in science study to the narrow limits of one or another of the fields into which scientific phenomena are for many purposes very properly grouped."

He introduced a course known as Science I which ^{was}~~was~~ prescribed for all freshmen and was a prerequisite for later elective science courses. It was his idea that the course would accomplish the following purposes:

1. Introduce the pupil to a study of natural phenomena and laws adapted to his maturity.
2. Train him to think accurately and form just conclusions from data gathered.
3. Furnish useful information.
4. Prepare for further systematic science study.
5. Conform to Illinois law for teaching physiology and hygiene in the first year of the high school.

General science is now widely taught in the high schools of the state and since it may now be accredited at the University most high schools will probably introduce it into the curriculums.

The "project method" of science teaching is noe of the later movements in this field. There is a wide variance of opinion as to just what this method is and a correspondingly wide difference in its practice. Stevenson probably gave the best definition

1. School Science and Mathematics, 1916, p. 210.

of it when he said that it was the carrying on of an experiment under actual conditions. The project method when properly applied has resulted in increased interest and efficiency. Probably its most effective use has been in connection with Smith-Hughes agriculture work.

VI. SCIENCE TEACHING IN COLLEGES, NORMAL SCHOOLS, AND UNIVERSITIES

The science courses offered in the early colleges of the state were very much alike. Among the subjects listed as being taught in these early schools we find mentioned natural philosophy, chemistry, geology, and in some cases mineralogy. The work in these subjects, as in the secondary schools, was largely of an informational character and the methods of teaching them differed but little from the methods employed in teaching the other subjects in the curriculum. The most of the early colleges boast of the fact that they were equipped with a philosophical and chemical apparatus. About 1850 the museum or cabinet of specimens came to be considered an important part of the equipment necessary for science teaching. The work, however, continued to be largely informational and the apparatus and cabinet of specimens were used to illustrate the regular class work. The laboratory method of teaching science was introduced into the state in the early 70's. Professor S. A. Forbes first used the type method of laboratory instruction in his classes in zoology at Normal. He had begun this method of teaching "before Huxley's Laboratory Guide appeared and revolutionized the teaching of zoology." The laboratory method quickly spread to the other sciences and has continued to be considered an essential part of all kinds of science instruction. No college of today would be considered a standard college which offered science instruction and did not provide

adequate laboratory facilities for such science courses as were offered.

Dr. David Starr Jordan's experience in an Illinois college prior to the wave of increased interest in scientific subjects that swept over the state in the early 70's gives some interesting information concerning the status of the sciences and the science teacher in the early colleges of Illinois. He says, "I was called from New York to such a chair (natural history) in a well-known college of Illinois. As professor of natural science I taught zoology, botany, geology, physiology as a matter of course; physics, chemistry, mineralogy, natural theology, and evidences of Christianity, because there was no one else to take them. There finally fell to me the literary work of the college--the orations, essays, declamations. I tried at one time to establish a little laboratory in chemistry, but met with a sharp rebuke from the board of trustees, who directed me to keep the students out of what was called the cabinet, for they were likely to injure the apparatus and waste the chemicals."¹

Shurtleff College, the pioneer Illinois college, at its first organization, as has already been noted, gave special prominence to the subject of natural philosophy. Of the first two professors selected for the college, one taught Christian theology and the other, mathematics and natural philosophy. The curriculum on the whole, however, was in conformity with the traditional college curriculum of the times. The course of study reported as a-

1. N. E. A. Proceedings, 1899, p. 1101.

adopted in 1839 contains no scientific subjects, although the faculty list for that year shows that the Rev. Washington Leverett, A. M., was professor of mathematics and natural history. He is still reported as holding the same position in the college in 1849. In addition, however, in 1849, Erastus Adkins, A.M., is reported as professor of oratory, rhetoric, and belles lettres, also professor of chemistry and mineralogy. President Leverett reported to the trustees in 1850 that "to the philosophical and chemical apparatus no additions have been made. The cabinet has been increased by the addition of a considerable number of mineralogical specimens from different localities in several states of the Union. Henry Spaulding has deposited some twenty specimens, collected mostly in Arkansas." The faculty list for 1869 contains the names of Charles Fairman, A. M., Edwards professor of mathematics and natural history, and Ebenezer Marsh, Jr., A. M., Ph. D., Hunter lecturer on chemistry, geology, and mineralogy. In 1889 Charles Fairman, LL.D., is both Edwards professor of mathematics and natural philosophy, and Hunter lecturer on chemistry, geology, and mineralogy. L. F. Schussler, M. D., was professor of natural sciences and David H. Jackson, B. L., instructor in American history and physiology. In the same year, 1889, a donation of four hundred dollars was received by the college for the purchase of physics apparatus. "This was practically the beginning of the physical laboratory, for the equipment prior to the time of this unexpected gift was exceedingly scant."

The science work at McKendree College, the second college established in Illinois, was in the early days of the college very similar to that offered at Shurtleff. The higher branches

taught at McKendree at first were mathematics, natural and moral philosophy, and the Latin and Greek languages. The articles of organization of the school in 1828 provided for a board of managers "for the governing of the institution, selecting professors and teachers, library, astronomical, chemical, and philosophical apparatus, elementary books, etc." The articles of incorporation issued in 1835 provide among other powers and duties of the trustees that they should "purchase books and chemical and philosophical apparatus, and other suitable means of instruction."

The Illinois State Normal University, located at Normal, Illinois, has had much to do with the development of science instruction in the state. It was established "to qualify teachers for the Common Schools of this State, by imparting instruction in the art of teaching; in the branches of study which pertain to a Common School education; in the elements of the natural sciences, including Agricultural Chemistry, Animal and Vegetable Physiology." "It was foreseen that the course of study in the University would eventually be reproduced in a thousand villages and settlements all over the prairies; that if the Natural Sciences found place in the course here, they would there."

The characteristic of educational leaders of Illinois to encourage every step in advance was particularly true of the early teachers at the State Normal University. Superintendent Brooks reports in 1864 that "nowhere has this generous and sensible tendency been more manifest than in the matter of the Normal University." It is difficult to estimate correctly the great service rendered by the Illinois State Normal University in the de-

velopment of the schools of the state.

Not much was done in the way of science instruction in the first year after the school's organization. A fund of about one thousand dollars was donated by the Messrs. Merriam of Massachusetts to be used in purchasing philosophical and chemical apparatus. Five hundred dollars of this amount was expended in 1857 for philosophical apparatus and the remainder was reserved for purchasing chemical apparatus whenever it should be required. At the beginning of the second year, September, 1858, E. R. Roe was reported as lecturer in chemistry and philosophy. At the beginning of the fourth year, 1860, Joseph A. Sewall was instructor in natural sciences. The report of the University for the fifth year shows the following courses in science offered:

Chemistry, second term, second year, thirteen weeks.

Botany, third term, second year, twelve weeks.

Physiology, first term, third year, fifteen weeks.

Natural philosophy, first term, third year, fifteen weeks.

Zoology, third term, third year, twelve weeks.

The methods of these early science courses in the Normal University "were not those of the modern science teacher." Professor Forbes in an interesting way characterized the work of that period in the School's history.¹ "Botany was chiefly a study of text and the analysis of plants; the chemistry was apparently poured over the heads of the pupils like a shower bath, and there was no student's laboratory for many years; the physiology was demonstrated

1. Forbes' History and Status of Public Science Work, p.4.

to the imagination only; and the physics was taught as a department of mathematics, by deduction from first principles, with a sovereign contempt for apparatus and experiment, not merely implied but vigorously expressed. Zoology was not regularly introduced until after 1872." The early work was hampered, too, by a lack of apparatus and supplies. In the report for 1867-1868 we find that "with a professor in chemistry and the natural sciences, second to none in the West; and with a room in the University building admirably planned as a laboratory, no apparatus or furniture has as yet been supplied for want of the necessary means at the disposal of the board."¹

The next few years brought marked improvement in the science instruction in the University. We find it reported in 1874 that "Among the subjects taught in the institution, natural sciences hold a prominent position. With the museum of natural science, and its thoroughly classified and catalogued contents, entirely and easily accessible to every student that wishes to study them; with the ripe attainments of Dr. Sewall, and the intense enthusiasm of Professor Forbes to direct and inspire the students, it is believed that the Normal furnishes an excellent opportunity for acquiring a thorough and practical knowledge of these sciences. As a consequence the interest that has been awakened in the classes in these subjects is marked. No other class of studies is, on the whole, more popular. In none is the desire for instruction and progress more eager."²

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1. State Superintendent's Report, 1867-68, p. 354.
 2. Ibid., 1873-74, p. 127.

"It is believed that no other state normal school in the country has, as a part of its own permanent equipment, such extensive facilities for the study and illustration of natural history as afforded to the students of this school by this museum. I am glad to be able to add that there is an increasing disposition to utilize these rare privileges."

The modern laboratory method of instruction was introduced by Professor Forbes in his zoology work at the State Normal University in 1874. The introduction of this method in zoology and the other sciences is probably the most important and far-reaching change introduced during the whole history of science instruction in the schools. Professor Forbes was given charge of the zoology classes and at his request a zoological laboratory was fitted up in a basement room during the summer of 1874.¹ It was provided with stools, dissecting tables, sinks, washing conveniences, etc. According to Professor Forbes' statement the new laboratory "answered its purpose admirably." Dissections were made "each term by the pupils of the zoology classes, at an average cost for materials, etc., of about three cents a day per pupil. There is probably no other institution in the state--perhaps not another in the West--which affords advantages for the study of natural history superior to those now open to the students of our Normal University."

The Illinois State Normal University with the State Museum located in one of its buildings "created a little center of scientific activity, the spark of whose life has never yet gone

1. State Superintendent's Report, 1875-76, p. 80.

out in Illinois." The names of many of the men connected with the early science instruction at the Normal University, such as Sewall, Wilber, Holder, Powell, Thompson, Vasey, Forbes, and Colton, will be long held in grateful remembrance by the future scientists of the state. Their work "stood from the beginning in close relation to the schools" and influenced strongly the trend of science instruction in the schools of the state.

In more recent years the Illinois State Normal University has done much to promote nature study work in the elementary schools. Charles and Patterson are familiar names to those acquainted with this field. Pricer, through his regular work in biology and his work in the Biology Section of the High School Conference, has done much to stimulate an interest in biology and to outline courses for secondary schools. Barber is, with others, the author of a general science text that is widely used.

The second state normal school was the Southern Illinois State Normal University, organized in and located at Carbondale. From its first organization special emphasis was given to science instruction. The first published curriculum offers the following science courses:¹

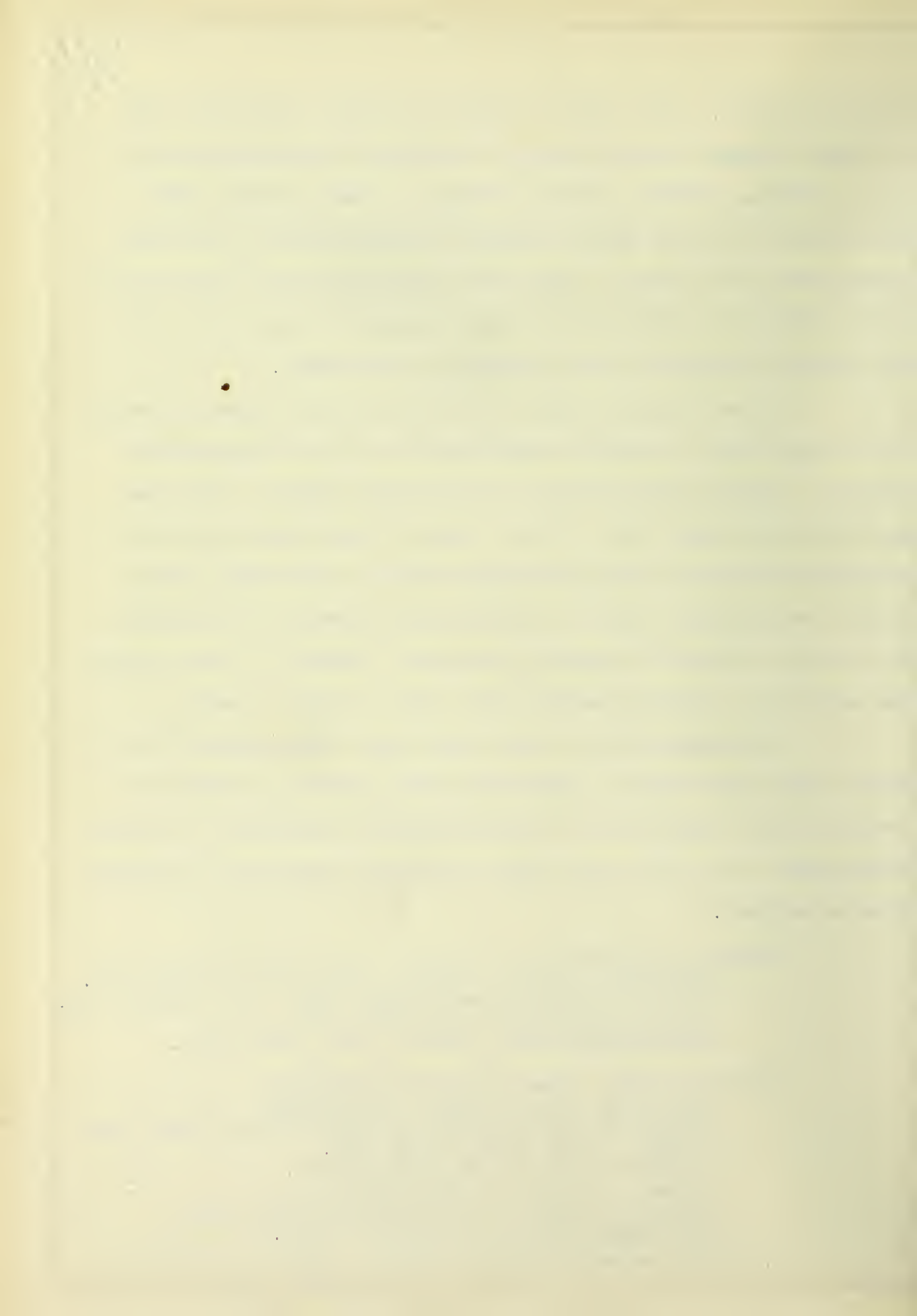
Preparatory Course:

Elementary natural history, third term, first year.
Botany, elementary astronomy, third term, second year.
Physiology, first term, third year.
Natural philosophy, second term, third year.

Normal Course - Classical and Scientific:

Physiology, second term, second year.
Botany, natural philosophy, third term, second year.
Zoology, first term, third year.
Chemistry, second term, third year.
Geology, third term, third year.
Physical geography, first term, fourth year.
Astronomy, second term, fourth year.

1. State Superintendent's Report, 1886-87, p. CLXXVIII.



"A post graduate year will be added, which will include calculus, history, political economy, chemical analysis, dissecting, and preserving specimens of natural history, field work in botany, and practical teaching with lectures on art, history, physics, etc."

It will be noticed from the arrangement of courses just given that the most of the courses named are of the single term informational type which was common at that time and for two decades later.

"On the 26th of April, 1870, Professor Cyrus Thomas, of De Soto, Jackson County, was appointed to the chair of Natural Science in the University. The Board took this early action in this case, in order to secure to the University the eminent abilities of professor Thomas, and that he might at once engage in the work of making collections for a cabinet of specimens, to be ready for use when the building should be completed, and the Institution be opened for the admission of students. Professor Thomas is recommended by such men as Professor Hayden, U. S. Geologist; Professor Henry, of the Smithsonian Institution; Ex-Governor J. D. Cox, late Secretary of the Interior, and others, and is believed to possess unusual qualifications for the position to which he has been appointed."¹

Professor Thomas soon after the opening of the school was appointed to the position of State Entomologist, so he was able to give but little of his time to science instruction in the University. However, with Professor French, he made valuable collec-

1. State Superintendent's Report, '67-'70, p. 89.

tions for the school's museum. During this early period the school museum was considered an important and almost indispensable part of science instruction. In 1883 a fire destroyed the Southern Illinois Normal University Museum collections. Professor French as curator later replaced many of the specimens destroyed by the fire. The work in the Model School at its organization included object lessons, and primary lessons in natural history.

In recent years the normal schools of the state have kept in touch with all progressive movements in science instruction. Applied science material rather than "pure science", material has been ably advocated by many of the normal school science men. Caldwell, of the Eastern Illinois Normal School; Gilbert, of the Southern Illinois Normal University, and Johnson, of the Western State Normal School, were prominent among those who emphasized practical and applied science material as the basis for instruction.

The universities of the state have made large contributions to science and science instruction in Illinois. The two universities that stand out most prominently in this respect probably are the University of Chicago and the University of Illinois. Their contributions may be classified under the heads of, (1) scientific research, (2) text books written by teachers in the universities, (3) preparation of teachers, (4) extension work through lectures and correspondence courses, (5) teachers' conferences.

The important scientific contributions of the University of Chicago have been made since its reorganization in 1892 under President Harper. The old University, while it had a long and

memorable career, had little in connection with its scientific work to distinguish it from other colleges and universities of its time. The reorganized university, however, because of its large financial resources, was able under the leadership of Dr. Harper to assemble a faculty of eminent scientific specialists and to build and supply laboratories with the best available equipment. While Dr. Harper's preparation and interests were largely along the line of the humanistic studies and it was his ambition to build up strong departments along those lines, he did not neglect to build up also strong scientific departments. The building up of the strong scientific departments was made possible through the liberal donations of several wealthy residents of Chicago. The story of the organization and rapid development of the University of Chicago is indeed an interesting one.

Before the formal opening of the University Dr. Harper wrote that it was "one of the cherished plans of those most intimately connected with the organization to devote special attention to the encouragement of scientific research."¹ At first Dr. Harper found it difficult to induce strong men to leave other universities and to ally themselves with the new school. However, later, when strong financial support was assured and his plan of organization appeared certain to succeed, he found much less difficulty in surrounding himself with men of the ability that he desired for the new school. The first faculty list announced contained the following names as heads of departments or professors in scientific departments:²

1. History of the University of Chicago, p. 174.

2. Ibid., p. 486.

Thomas Chrowder Chamberlain, Ph.D., LL.D., Head Professor of Geology and Dean in the college of Science.

Charles O. Whitman, Ph.D., Head Professor of Biology and Professor of Animal Morphology.

Albert A. Michelson, Ph.D., Head Professor of Physics.

Rolin D. Salisbury, A.M., Professor of Geographic Geology.

Franklin P. Mall, M.D., Professor of Anatomy.

John Ulric Nef, Ph.D., Professor of Chemistry.

Other familiar names appearing on the first faculty list were C. R. Van Hise, Frederick Starr, Jacques Loeb. With such names on the first faculty it was easy to predict that the University would soon be a leader in scientific lines.

The organization of the Ogden Graduate School of Science was one of the first important steps in the development of the science work of the University. It was provided in the will of William B. Ogden that a large amount of money should be devoted to charitable purposes. After considerable correspondence, the executors of the estate decided to give seventy per cent of the monies left for charitable purposes to the University of Chicago for the establishment of a graduate school for scientific research. The Ogden Graduate School of Science was organized as a result of this gift and received in all about six hundred thousand dollars from the Ogden estate.¹

A second impulse to the further development of science work resulted from the erection of the Kent Chemical Laboratory. In February, 1892, Sidney A. Kent offered to build and equip a

1. History of the University of Chicago, p. 174.

chemical laboratory to be known as the Kent Chemical Laboratory. The erection and equipment cost him two hundred thirty-five thousand dollars. Ira Remsen came from Baltimore to assist the architect in working out plans and details for the building. It was formally dedicated on January 1, 1894.

A third step in the expansion of the scientific work of the University was the building of the Ryerson Physical Laboratory. This building was dedicated on July 2, 1894. In accepting the building, President Harper said, "There may be larger laboratories. There may be one or two that have cost more money; but there is not one which contains as little waste room or as much working space, or that is provided with as many useful conveniences as the Ryerson Physical Laboratory." The original building cost approximately two hundred thousand dollars. In 1910 Mr. Ryerson built and equipped an annex to the original building at an additional cost of two hundred thousand dollars.¹

In the first years of the University the provisions for the Biology Department were wholly inadequate. Professor Whitman says that "Our earliest days in the University were spent in the garrets and kitchens of a tenement house. We were then tenderly transferred to the unused corners of Kent Chemical Laboratory where - - - we struggled for three years for bare existence."²

A most welcome and at the same time unusually liberal donation was made in 1895 by Miss Helen Culver who gave a million dollars to be devoted to the increase and spread of knowledge within the field of the biological sciences." As a result of this gift four

1. History of the University of Chicago, p. 240.

2. Ibid., p. 305.

laboratories were built--zoological, anatomical, physiological, and botanical. The four buildings were arranged in the form of a quadrangle and are known as the Hull Biological Laboratories. They were dedicated July 2, 1897.

Two other buildings worthy of notice are the Walker Museum and the Yerkes Observatory. George C. Walker, in 1892, donated one hundred thousand dollars to build a museum to be known as the Walker Museum. The building was dedicated on October 2, 1893. It has been used since that time not only as a museum but as a lecture hall for geology, geography, anthropology, and paleontology.¹ During the first week of the University, Charles T. Yerkes arranged to build one of the most complete astronomical observatories in the world for the University. At first it was proposed to locate the observatory in Chicago, but, owing to the usual smoky condition of the atmosphere, it was finally decided to locate it at Lake Geneva. It was finally completed in the year 1897.²

These descriptions of science laboratories at the University of Chicago have been given at some length to show the real facilities afforded by the University for science work in all fields. The men at the heads of the different departments are men of international reputation in their respective fields. Professor Thomas Chamberlain was brought from the Presidency of the University of Wisconsin to the position of Professor of Geology and Dean of the College of Science. During the first two years of the University no instruction was offered in botany. In July, 1894, Dr. John M. Coulter, then President of Lake Forest University, became a lecturer

1. History of the University of Chicago, p. 230.

2. Ibid., p. 307.

in botany.¹ He came to the University three times per week to lecture. Two years later he resigned his position as President of Lake Forest University and accepted a position as head of the Department of Botany at the University of Chicago. Dr. Coulter has been influential in the field of botany through his reorganization of the subject matter and in redirecting the trend of thought in botany work along ecological lines.

It was a part of Dr. Harper's plan for organizing the University of Chicago that in addition to the organization of regular departments as was the usual custom of universities, its influence should be further extended through correspondence courses, extension lectures, and a department of publications. His ideas along this line have been fully justified and through the methods named the work of the University has been more widely extended.

The work of the secondary schools has been influenced greatly through the text books written for high school use by members of the faculty of the University. In the field of science Coulter's text books on botany, Salisbury's Physical Geography, Millikan and Gale's Physics, Caldwell and Eikenberry's General Science have had a wide use in the high schools of the state and have had much to do with influencing the character of the work done in these subjects. All of the text books just named are listed with the best sellers among high school texts.

The University of Illinois has had an important place in influencing science instruction throughout the state. Dr. Forbes has characterized the early years of the University in saying that

1. History of the University of Chicago, p. 322.

"The growth of this institution has been differentiated from the common standards of institutions of higher learning by the determination of its efforts and resources toward science rather than toward literature."¹ The foundation of the State University was the result of a campaign in which strong emphasis was laid on the sciences underlying the industrial arts. Through its regular science courses, its accrediting system, and the Annual High School Conference, the University has exerted an important influence in directing and influencing science teaching throughout the state.

The agitation which finally resulted in the founding of state universities throughout the nation had its origin in Illinois. Under the leadership of Jonathan Baldwin Turner a campaign was begun about 1850 for the purpose of securing an appropriation from Congress of a sufficient amount of public lands for each state "for the appropriate endowment for the liberal education of the industrial classes in their several pursuits in each state in the Union." Sentiment in Illinois was strongly infavor of the plan. The Morrill Land Grant Bill was introduced in 1857 by Senator Morrill of Vermont. It was "inspired by Turner, and in part composed in his language." The bill finally passed, but, owing to the fact that the President and Congress had for some time been unfriendly to each other, the bill was vetoed by President Buchanan. Abraham Lincoln in the campaign of 1860 promised Turner that if elected he would sign his bill for state universities. The bill was reintroduced into Congress, passed, and in accordance with his promise signed by President Lincoln. Edmund J. James, former President of the University said, "To Jonathan B. Turner, the Illinois professor

1. Report of State Superintendent, 1886-1887, p. CLVII.

and farmer, belongs the credit of having first formulated clearly the plan of a national grant of land to each state in the Union for the promotion of education in agriculture and mechanic arts, and of having inaugurated the agitation that made possible the passage of the so-called Morrill Act." With the passing of the years, the importance of Professor Turner's efforts in this educational campaign will gradually come to be more clearly recognized throughout the state and the nation.

After the acceptance of the grant by the State Legislature in 1863, a persistent and determined effort was made to divide the funds to be received from the grant among existing colleges. It was also proposed that an agricultural college be established down state and that a mechanical college be located in Chicago. Turner said in answer to these demands that "We wish now wisely to begin a peculiar university - - - which our posterity can erect into the strongest, broadest, and best university on the face of the earth. Our institution is wholly new."

Ardent advocates of this "peculiar" university strongly opposed the introduction into the curriculum of English literature, and the study of ancient and modern languages. It was their idea that only the directly practical subjects directly connected with industrial occupations should be taught. Because of difference of opinion on this particular point, the policy finally adopted was strongly opposed. Many influential persons failed to support the University, and its growth and development were seriously retarded.

On March 12, 1867, Dr. John Milton Gregory was elected Regent. The fact that he was a Doctor of Divinity and had a "deep-

er reverence for the classics than was precisely necessary for that section of the corn belt" served to alienate many farmers and others who had been original promoters of the plan for the University. Even Professor Turner would have nothing at all to do with the University for several years after it was started. It was his opinion that the right kind of men had not been selected as members of the faculty. He thought that the "Teachers ought to be men who had made the sciences of agriculture and horticulture their special studies--not mere book scholars." The differences of opinions and dissensions extended even to the meetings of the Board of Trustees. M. L. Dunlap, one of the trustees, opposed the policies of Regent Gregory because as he said he "felt the want of a more thorough scientific course of study." He regretted the fact that his "own researches in the department of chemistry had not been more given in the direction of soils, rather than to medicine." ¹ The first faculty members selected afforded according to his opinion a "poor outlook for agriculture or mechanic arts." Dunlap objected to the Bromley purchase saying that he thought that an Illinois collection would be of more benefit. There were those who believed that the new institution would be nothing more than another of the "old colleges" and it was asked "Why add, by a public grant of lands, to these old institutions, of which the people already have too many?"

The first arrangement of curriculums was prepared by a committee composed of five members of the Board of Trustees with

1. Powell's University of Illinois Semi-Centennial History, p. 288.

Dr. Gregory as chairman. The following arrangement of the work planned for the University was reported by the Committee:

- I. Agricultural department
 - 1. Agriculture
 - 2. Horticulture
 - 3. Landscape gardening
- II. Polytechnical department
 - 1. Mechanical science and art
 - 2. Civil engineering
 - 3. Mining and metallurgy
 - 4. Architecture and fine arts
- III. Military department
 - 1. Engineering
 - 2. Tactics
- IV. Chemistry and natural science
- V. Trade and commerce
- VI. General science and literature
 - 1. Mathematics
 - 2. Natural history, chemistry, etc.
 - 3. English language and literature
 - 4. Modern languages and literature
 - 5. Ancient languages and literature
 - 6.. History and social science
 - 7. Philosophy (intellectual and moral)

The curriculum arrangement reported evidently was planned to meet the criticism of those who demanded practical subjects. It is interesting to note that the first subjects actually taught at the opening of the University were algebra, geometry, natural philosophy, history, rhetoric, and Latin.

The first faculty consisted of three members beside Regent Gregory--William Baker, George W. Atherton, and Jonathan Periam. Willard F. Bliss was elected Professor of Agriculture, March 10, 1868. The next man added to the faculty was Thomas J. Burrill. He was a graduate of the Illinois State Normal University, had accompanied Major Powell on his famous expedition to the

Rocky Mountains, and was Superintendent of Schools in Urbana when he was called to a position in the University. He took charge of the work in natural science in April, 1868. In August, 1868, he was elected Assistant Professor of Natural Science. In August, 1868, A. P. S. Stuart of Harvard university was elected as teacher of chemistry. In addition to providing science teachers and in order to satisfy critics of the University, the following resolution was passed by the Board of Trustees: "Resolved that we recognize it as a duty of the board of trustees to make the University pre-eminently a practical school of agriculture and the mechanic arts, not excluding other scientific and classical studies."

A museum or a cabinet of scientific specimens was considered an essential part of the equipment for science teaching at the time the University was established. At an early meeting of the Board of Trustees a sum of money "not to exceed six thousand dollars" was set aside to be used in purchasing the Bromley cabinet. This cabinet was a collection of specimens in the fields of mineralogy, geology, and conchology made by Professor Bromley of Georgia. On inspection of the cabinet by Regent Gregory, the specimens were found to be in poor condition, and consequently the cabinet was not purchased for the University.

Five hundred dollars were appropriated by the Trustees to Major Powell to assist in paying the expenses of his Rocky Mountain expedition. It was expected that in return for this financial assistance the University would receive a number of specimens for its collection. In March, 1868, Major Powell appeared before the

Board of Trustees, discussed his expedition, and promised them specimens. The University, however, never received as large a number of specimens from this source as they were led to expect. Some of those which were received may yet be seen in the natural history museum at the University.

The first natural history survey and collecting trip was made in the summer of 1869. An appropriation of three hundred dollars was made for this trip by the Board of Trustees and placed in the hands of T. J. Burrill. In company with five or six student assistants, he travelled through several different parts of the state making a collection of specimens for the University. They collected plants, birds, reptiles, insects, mammals, a number of fossils, of fresh water shells, and of minerals, with some specimens of different kinds of woods, soils, materials of manufacture, and of manufactured articles."

Chemistry was probably the first science to be developed as a laboratory subject at the University. In 1868, A. P. S. Stuart of Harvard University was employed to teach chemistry. In 1869, five thousand dollars were appropriated for the chemical department. In 1870 we learn that "the important relation which chemistry sustains to agriculture and the mechanic arts, is recognized in the interest that crowds the somewhat contracted limits of that department, with students."¹ "The advanced class in chemistry nearly fills the 24 tables of the working laboratory, and the new class of 50 members overflows the recitation room, and will soon need a place for work." Later, in 1874, when Professor Stuart was assigned a basement room in the old building for

1. Third Annual Report, Illinois Indus. Univ., p. IX.

his work, he resigned, saying that he "had had enough of basement service." His resignation led the trustees to build a separate building for the chemistry department a few years later.

It is interesting to note that John W. Powell was elected Professor of Natural History, March 11, 1868. However, he never entered service and resigned the following year. Don Carlos Taft was engaged in 1871 to teach geology. He later was elected Professor of Geology and Zoology. After Professor Stuart's resignation in 1874, Henry A. Weber was employed to teach chemistry. He was made Professor of Chemistry in June, 1875.

From the early days of the University chemistry was one of the most popular subjects. Because of crowded conditions a chemistry building was erected in 1877. The cost of the building was \$30,000. Compared with the present day cost of buildings, this is a modest expenditure. However, at that time it was one of the best and largest chemistry laboratories in the United States. This building is now used by the Law School.

By 1880, regular laboratory work by the pupils had become an established practice. The Regent reports¹ that "the study of physics occupies two college terms, in which there are each week five recitations from a text book, one lecture, and four hours of laboratory practice. In the latter, a series of about forty experiments are performed by each student, two working together according to a program arranged for the purpose. Besides the written directions for the method of procedure, the student has the aid of the Professor and his assistants, when needful. Careful notes and calculated results are required on paper of a

1. Tenth Report, University of Illinois Trustees, p. 24.

given size."

Because of the success of his work in zoology at the Illinois State Normal University, efforts were made to bring Professor S. A. Forbes to the State University, but Regent Peabody's efforts were at first unsuccessful. However, arrangements were finally made and he began work January 1, 1885. He at once asked for laboratory room and equipment. In a communication to the Board of Trustees he said, "For the further accomodation of the classes in zoology and entomology, the principal need, and a very pressing one, is that of a student's laboratory for the study of zoological specimens."

The results of Professor Forbes' work was soon apparent. The Regent says,¹ "The unsuccessful effort of three years ago to secure for the University the presence and aid of Professor S. A. Forbes for the organization of the instruction of zoology was renewed last year and has been crowned with better fortune. Since the first of the new year the zoological laboratory has become an active agency in this department of physical science, and its success is well assured. A new interest has been aroused in this science. The office of the State Entomologist has found a home, it is to be hoped permanent, where it naturally belongs. The governing board of the Normal University has unanimously resolved that the State Laboratory of Natural History should find its proper abode here at the State University, and has consented that the property peculiar to the work of that laboratory may be transferred hither."

1. Thirteenth Report, Board of Trustees, University of Illinois, p. 19.

The work under Professors Forbes and Burrill expanded rapidly and soon agitation was begun for a second separate building to be used for natural science instruction. A Natural History Building was erected in 1892 at a cost of \$70,000. In 1909 an addition was erected at a cost of \$165,000, making the total cost, including the old building, \$245,000.

Soon after entering upon his term of office, President Draper expressed the conviction that the University must ask for much larger appropriations." The number of students was rapidly increasing. Other state universities were receiving more liberal appropriations from their legislatures. The University of Chicago had just been reorganized with large resources and hitherto unheard of and almost fabulous sums were being spent in erecting buildings. A chemistry building, a physics laboratory, and biological laboratories were built and equipped by wealthy Chicago residents. All of these had an influence on plans made for the expansion of the State University. As Dr. Burrill well said while standing on the steps of the Ryerson Physical Laboratory at the University of Chicago, "The people of the state will never appreciate what this institution has meant to us at the old University."¹

The third science building to be erected on the University campus was a new chemistry building. The old chemistry building, for years the pride of the University authorities, became wholly inadequate for the growing needs of that department. An appropriation was secured and a new building erected at a total cost of \$180,000. In 1916 it became necessary to build an addition to this building. The addition cost \$360, 956, making the

1. Alumni Record, 1918, p. XVII.

total cost of the present chemistry building \$540,956. A fourth science building, the physics building, was erected in 1909 at a cost of \$220,000.

The State University has in many ways influenced the development of the state. Nevins¹ has pointed out that "where the University comes closest to the life of the state is in the fields of teaching and agriculture; and perhaps its most direct influence is in the former. - - - It trains a large part of the secondary school teachers, and through the school of education and the office of high school visitor, held since 1902 by H. A. Hollister, it cooperates with the public authorities in determining their standards." The Annual High School Conference, held by the University under the direction of the High School Visitor, has had an important influence on secondary school instruction throughout the state. We can readily agree with President James' statement that "The grain of mustard planted by the Boneyard stream in 1867 has indeed become a great tree."

1. Nevins' Illinois, p. 326.

VII. ORGANIZATIONS PROMOTING SCIENCE TEACHING

1. The Illinois Natural History Society

In June, 1858, the Illinois Natural History Society was organized by some of the leading scientists of the state for the purpose of conducting a scientific survey of the state "in order to afford new sources of valuable knowledge to our citizens." It was stated as the aim of the Society "to carry on this work (scientific survey) until completed, and to establish a Museum of Natural History at the State Normal University, comprising every species of plants, birds, shells, fishes, insects, quadrupeds, minerals and fossils, found in Illinois, together with such collections from the various parts of the world as will assist our youth in gaining a knowledge of the general studies of Nature."¹

"We have over fifty species of quadrupeds, three hundred of birds, one hundred of reptiles, nearly two hundred of fishes, and thousands of insects, mollusks, etc. It is the purpose of the Society, as soon as its condition will permit to publish reports containing descriptions of the various orders of Animal and Vegetable life--or, a complete Fauna and Flora of Illinois--a copy of which should be within the reach of every parent, teacher and pupil in our State."

"By establishing the Museum of the Natural History Society at the State Normal University, it becomes directly available for the purpose of instruction. And since students in at-

1. State Superintendent's Report, 1857-58, p. 408.

tendance are from all parts of the State, they will each have an opportunity of studying the Natural History, not only of his own, but all other sections of Illinois. The scientific survey now in vigorous operation may, therefore, be regarded as a direct auxiliary to the educational and agricultural interests of the Prairie State."

It was the policy of the Illinois Natural History Society to distribute to the public schools of the state "such of its duplicates as were not used for exchange." Many thousand specimens were thus furnished gratuitously to schools throughout the state and probably served a valuable purpose in increasing an interest in the natural sciences. The results, however, did not measure up to the expectations of those who inaugurated the distribution. In many schools the specimens were not properly cared for and were soon destroyed. Many teachers did not know how to use such collections in an effective way in their teaching. It was reported, too, that "the distribution created the impression that natural history specimens might be had for the asking and there was not sufficient incentive for schools to collect and prepare specimens for themselves." The Illinois Natural History Society became inactive and gave place to a new organization called the High School and College Association of Natural History.

2. High School and College Association of Natural History¹

After the Illinois Natural History Society ceased its

1. State Superintendent's Report, 1873-74, p. 143.

activities a new society to carry on and extend the work undertaken by the old organization was planned. After considerable correspondence in the Autumn of 1873 a number of persons interested in natural history were invited to meet at Bloomington during the session of the State Teachers' Association in the Christman holidays. "A large and earnest meeting of teachers" was held and after an "animated discussion the new society was formally organized under the name of the School and College Association of Natural History of the State of Illinois. The purpose of the new organization was given out was in many ways similar to that of the old society. The purpose was "first, to collect, study and exchange specimens in natural history, and to contribute to a natural history survey of the State; second, to form a state museum; third, to obtain for the schools with which its members are connected, suitable cabinets of specimens for study and reference; fourth, to encourage and assist the rational study of nature by the pupils of our schools."

Under the auspices of the High School and College Association a notable vacation school of natural history was held at Normal, Illinois, in July and August, 1875. This school was modeled in some ways after Agassiz's noted school at Penikese. The instructors in this school were Professor S. A. Forbes, of the State Normal University; Professor B. G. Wilder, of Cornell University; Professor W. S. Barnard, Ph.D., Professor T. J. Burrill, of the Illinois Industrial University; Professor Cyrus Thomas, State Entomologist; and Dr. J. S. Sewell, of the State Normal University. The attendance was limited to fifty students but within

that limit was opened to the teachers of the state. "The work was definitely planned beforehand to meet what seemed to be the most urgent needs of the teachers of the state, and the courses of study thus laid down were adhered to throughout. While the leading idea was that of method, and the leading object to give practice in the peculiar processes of scientific investigation, it was not forgotten that, to the average teacher, a general knowledge of the whole is of more value than a special knowledge of a very little. The specimens selected for study were, therefore, typical ones, and the dissections and examinations were so planned and conducted that the facts demonstrated were true, not of the species or genus only, but of the whole class or sub-kingdoms, or else notable exceptions to general statements about these larger groups."

"The laboratory work was made, throughout, the basis of the course, and the lectures were designed chiefly to explain and complete the knowledge gained with the scalpel and the microscope."

"The class was divided into sections, each section working 'in concert' on the same thing at the same time under the guidance of an instructor, and the programmes were so constructed that each student might do the work of the entire course."

This school undoubtedly had an important influence in improving science instruction in the state and in extending the laboratory method of instruction. These vacation schools were continued for several summers. Professor Forbes reports in the State Superintendent's Report for 1877-1878 that "vacation classes are organized each year for systematic field and laboratory work,

and have thus far met with good success. They are intended for teachers and specialists, of which from twenty-five to fifty are convened each summer."

3. State Laboratory of Natural History¹

The Museum began under the direction of the old State Natural History Society was transferred to the State Board of Education, the official title of the Board of Trustees of the State Normal University, in 1871. From the State Board of Education it received the name Illinois Museum of Natural History. In a set of resolutions adopted in 1875 by the State Board they say, "We regard the Museum as a State Institution, devoted to the prosecution of a natural history survey of the State - - - and we consider it an important part of its work to supply collections of specimens to public schools, - - - and especially to provide all needed facilities for the instruction of teachers in natural history, and in the most approved and successful methods of teaching same."

A law passed in 1877 provided for the establishment of a State Museum at Springfield. Much material from the old museum at Normal was transferred to the State Museum at Springfield. The old museum was then changed into a State Laboratory of Natural History under which name it has continued to the present time. This change of name indicates to some extent the change from the old museum point of view in the teaching of natural science to the newer laboratory point of view. One function of the State Laboratory of Natural History at the time of its origin was to collect, preserve, and classify botanical and zoological specimens for the State Museum

1. S. A. Forbes, The Illinois State Laboratory of Natural History, p. 61.

at Springfield. In 1883, Professor Forbes who was director of the State Laboratory of Natural History was appointed to the office of State Entomologist. In 1884 the office of the Director of the State Laboratory and State Entomologist was transferred from the State Normal University at Normal to the State University at Urbana where it has remained to the present time. In 1894 the State Laboratory of Natural History by a joint arrangement with the State University established a biological station on the Illinois River where much valuable research work has been done. The State Laboratory of Natural History has throughout its history been an important center for the training of the science teachers of Illinois. It has further rendered a valuable service to science instruction in the state by preparing and distributing many pamphlets and bulletins on the plant and animal life of the state.

The State Laboratory of Natural History under the provision of the Civil Administrative Code passed by the state legislature in 1917 has been merged with the State Entomologist's office into a division called the Natural History Survey under the Department of Registration and Education. The new division thus formed includes the functions of its predecessors with a few additions. A notable addition to its functions is that of making a forest survey of the state.

4. The North Central Association of Colleges and Secondary Schools

The North Central Association of Colleges and Secondary Schools has exerted a strong influence toward improving the high schools of Illinois. Representatives from a few colleges and sec-

ondary schools met at Northwestern University, March 29, 1895, and decided to launch such an organization. The first regular meeting was held April 3 and 4, 1896, at the University of Chicago. The aim of the organization has been expressed as, "First, to bring about a better acquaintance, and keener sympathy, and a heartier cooperation between the colleges and secondary schools of this territory."¹

It was the original intention to hold meetings largely for discussion of topics of common interest. However, in 1901, Dean S. A. Forbes of the University of Illinois read a paper on "The Desirability of so Federating the North Central Colleges and Universities as to secure Essentially Uniform or at least Equivalent Entrance Requirements." As an outcome of the discussion of Dean Forbes' paper it was decided to appoint a Commission on Accredited Schools. The Commission on Accredited Schools when appointed was assigned as duties:

1. To define and describe unit courses of study.
2. To act as a standing committee on uniformity of admission requirements.
3. To secure uniformity and economy in high school inspection.
4. To prepare a list of accredited schools.

The Commission appointed made the first report at the Cleveland Meeting, March 28 and 29, 1902. The report was adopted and "cannot but be regarded as making an era in the educational history of the North Central States." The report of the Commis-

1. Twenty-Seventh Report of the North Central Association, p. 4.

sion set high standards for high school work which have been revised and added to by the reports of succeeding years. These standards have been discussed already under Science Teaching in Public Secondary Schools Since 1892. The report of the Committee on accredited high schools each year constitutes "an honor list for the North Central States." Recently the North Central Association has submitted a list of approved colleges and universities. This list has tended materially to improve the grade of work done in the colleges, particularly the smaller ones. "The Association is the most generally recognized standardizing agency in the North Central States--if, indeed, it does not rank first in prestige in the entire United States."¹

1. Twenty-Seventh Report, North Central Association,
p. 4.

VIII. CONCLUSION

As we view in retrospect the history of the century of scientific development covered by this discussion we are impressed by the evident fact that great changes both in the subject matter of science and the methods of science teaching have taken place. While changes in methods of teaching have received primary consideration, we would not lose sight of the fact that new and important scientific discoveries from time to time stimulated interest on the part of the public, and consequently influenced science teaching. Just now developments in the wireless field are serving as a stimulus to increase interest in the study of physics. Greater changes have probably taken place and more real progress has been made in the field of science than in any of the other large fields of knowledge.

The progress of science instruction in the elementary schools has been on the whole the least satisfactory of any of the divisions of our educational system. A few systems of elementary schools have well organized courses of science instruction. However, a large number, probably a majority of the elementary schools of the state make no provision for science instruction beyond the physiology and hygiene required by statute to be taught. There is a strong need of a revival of interest in science instruction in our elementary schools. Scientific facts constitute just as important a part of our common heritage and are just as important in adjusting ourselves to our environment

as are the facts of geography and history commonly taught. The elementary curriculum needs to be reorganized carefully and thoroughly with elementary science, including physiology and hygiene as required by law, as one of the basal subjects in the upper grades. With teachers properly trained and properly interested in such work the results would be a marked improvement over present achievements in our elementary schools. There would then probably be no need for a general science course in the first year of the high school.

The most important fact in the development of science instruction in the high school has been the introduction of the laboratory method of instruction. The early courses were largely short informational courses with some illustrative experiments performed by the teacher. It is true that this work was often times of a more interesting character to the pupil than some of the work that superseded it. However, this lack of interest was largely due to the organization of the subject matter and the method of presenting it or of introducing the pupil to it. Methods of laboratory instruction were introduced into the high school from the college and often the work was not sufficiently adapted to the ability and interests of the high school pupils. Present day methods are improving secondary science instruction through the use of projects and practical applications. However, the science work in our high schools is not producing the results that it ought to produce. Few pupils really acquire the scientific method of attacking problems which is generally acclaimed as one of the principal ends to be achieved as a result of science work. Few

persons who distinguish themselves in the line of scientific research first acquire an interest in such work in their high school courses. We need to hold the gains we have already made in secondary science teaching and strive to organize our material and present it in such a way that it will become of more vital interest to the pupil and have a stronger influence on his life. Better teaching will help to realize this ideal.

The absence of college or university domination in the early development of high schools in Illinois is worthy of special attention. It has recently been stated and without contradiction that all of our high school courses originally were handed down to us by the colleges and their content from the first has been determined by the college entrance requirements. This statement is not true of Illinois as far as scientific subjects were concerned. Nowhere is there evidence that a single science subject came into the curriculum through college or university prescription. Even in the case of general science the last scientific subject to be added to the curriculum there was a long fight before it was finally recognized for entrance by the colleges and universities. The wave of scientific interest that swept over the world after the middle of the nineteenth century probably reached a higher level in Illinois than in many other places. The sciences came into the high school curriculums after this wave of scientific interest because of the popular demand for them.

Next in importance to the introduction of the laboratory method of science teaching may be placed the movement for standardization. The evidence shows secondary education at a low ebb

in the early nineties. The reports of the various committees setting up definite standards, followed by the influence of the various accrediting agencies in securing the general adoption of proposed standards accounts for the marked progress of the past three decades. Without some outside influence to insist on high standards of work the development made would scarcely have been possible.

The universities and other higher institutions have naturally been the leaders in scientific progress. Of these the State University has probably exerted the greatest influence. They have through new discoveries extended the bounds of scientific knowledge, prepared science teachers for secondary schools, secured the adoption of high standards through their accrediting systems, and through friendly visits and mutual conferences called to consider secondary problems they have encouraged and helped high school teachers in the solution of their own problems. They have taken scientific discoveries and given practical application to them, thus often revolutionizing living conditions among the people. It is difficult properly to appraise the value of the universities' contribution to science and to science teaching.

We have traveled far in the development of science teaching in Illinois in the past century. Science has proven that it is worthy of an important place in all of our school curriculums. Many of our present standards are high enough. The problem of the future in science teaching is to develop such a technique of teaching as will insure that the boys and girls will secure the heritage of scientific facts to which they are entitled and at the same time develop more of the scientific attitude of mind. These

have long been the goals of science teaching but seldom have they been realized. It is the problem and at the same time the opportunity for future science teachers to work out the ways and means whereby these important objectives may be more fully realized.

APPENDIX I

Some Early School Advertisements

To the Friends of Education

The subscriber has opened a school in Prairie de Rocher, and proposes to teach the most useful branches of English education, viz. Writing, Reading, and common Arithmetic. Also, English Grammar, Geography, Surveying, Astronomy, and the Latin and Greek Languages. A commodious and comfortable house has been procured, and the situation is undoubtedly as healthy as any in the American Bottom. Good board can be obtained on moderate terms - and I can assure those disposed to patronize the school, that no attention will be wanting on my part, which will be necessary to progressive moral and literary improvement of my pupils.

Benjamin H. Sturges.

Prairie de Rocher, Aug. 26, 1816.

(From Western Intelligencer, Aug. 28, 1816.)

To the Patrons of Literature

J. Cheek,

Informs the friends and the guardians of erudition that he has opened a School in the town of Kaskaskia, for the instruction of youth, in the different departments of English literature. - He will extend the sphere of instruction, so as to include the following sciences, viz. Reading, Writing, Orthography, Arithmetic, English Grammar, Geography, History, Rhetorick, Composition, Elocu-

tion, etc. He flatters himself that from his attention to the morals and scientific avocations of his pupils, he will share no inconsiderable portion of the patronage of a judicious and discerning people.

Kaskaskia, Nov. 3, 1817.

(from Western Intelligencer.)

Education

Mr. Cross respectfully informs the citizens of Kaskaskia and its vicinage, that he intends, should sufficient patronage be afforded, to open a School in this town, for the instruction of youth, in Orthography, Orthoepy, Reading, Writing, English Grammar, Arithmetic, and Elocution.

Scholars who shall graduate in these branches of tuition, will be instructed in the rudiments of History, Geography, Natural Philosophy, and Mathematics.

Mr. Cross will endeavor to instill into the minds of his scholars, the vital importance of sound moral principle, and correct manners, which he will elucidate, by a regular course of lectures, every Saturday, as soon as he can procure the necessary appendages his school will be Lancasterian. No advance payment will be required, but a punctual compliance with the terms of subscription, at the expiration of each quarter, is confidently calculated upon.

Mr. Cross will this evening, in the Representative chamber, give various specimens of Elocution, instructive and amusing, original and selected. Tickets to be had at Burr and Christy's Hotel, and at this office.

Dec. 9th, 1818.

(From Western Intelligencer, Jan. 13, 1819.)

APPENDIX II

Course of Study of Chicago High School in 1872 ¹

Year	: First Term	: Second Term	: Third Term
First Year	: Algebra	: Algebra	: Algebra
	: Physical Geography	: Physiology	: Physical Geography and Physiology
	: Latin	: Latin	: Latin
Second Year	: Geometry	: Geometry	: Geometry
	: Natural History	: Natural History	: Botany and Natural History
	: Latin	: Latin	: Latin
	: General History	: General History	: General History
	: Greek (Optional in place of one of the English branches.)	: Greek (Optional in place of one of the English branches.)	: Greek (Optional in place of one of the English branches.)
Third Year	: Trigonometry	: Astronomy	: Trigonometry and Astronomy
	: Mechanics	: Physics	: Physics and Mechanics
	: Latin or German or French	: Latin or German or French	: Latin or German or French
	: Rhetoric, English Literature	: English Literature	: English Literature
	: Greek (Optional)	: Greek (Optional)	: Greek (Optional)
Fourth Year	: Mental Science	: Mental Science	: Mental Science
	: Chemistry	: Bookkeeping	: Bookkeeping
	: Latin, German or French	: Geology	: Geology and Chemistry
	: Civil Government	: Latin, German or French	: Latin, German or French
	: Greek (Optional)	: Political Economy	: Political Economy
		: Greek (Optional)	: Greek (Optional)

Composition, Drawing and Reading through course.

1. Eighteenth Chicago Report, p. 220.

Those in preparation for College who desire it, can omit the English branches, except the requisite Mathematics, and complete the course in three years.

Pupils from the High School Classes will commence with the studies of the second year, taking German instead of Latin.

Course of Study of Chicago High School in 1883¹

Full Course --- Four Years

Year	First Term	Second Term	Third Term
First Year	: Algebra	: Algebra	: Algebra
	: Physiology	: Physical Geography	: Physical Geography
	: Latin or German	: Latin or German	: Latin or German
	: Geometry	: Geometry	: Trigonometry
Second Year	: History	: History	: History
	: Latin or German	: Latin or German	: Latin or German
	: Natural History	: Natural History	: Botany
	: Botany	: Botany	
Third Year	: Natural Philosophy	: Natural Philosophy	: Natural Philosophy
	: Rhetoric	: English Literature	: English Literature
	: Latin, German or French	: Latin, German or French	: Latin, German or French
	: Chemistry	: Chemistry	: Chemistry
Fourth Year	: Astronomy	: Astronomy	: Astronomy
	: Civil Government	: Geology	: Political Economy
	: Latin, German or French	: Mental Science	: Latin, German or French
	: Study of Authors	: Latin, German or French	: Reviews
		: Reviews	

1. Twenty-ninth Chicago Report, p. 21.

1. Composition, Declamation and Select Readings through the course.

2. Drawing and singing optional through the course.

Greek elective after the first year.

Bookkeeping optional during the last year.

Classical Course --- Three Years

Year	:	First Term	:	Second Term	:	Third Term
First Year	:	Algebra	:	Algebra	:	Algebra
	:	Latin Reader	:	Latin Reader	:	Latin - Caesar
	:	Greek	:	Greek	:	Greek
Second Year	:	Geometry	:	Geometry	:	Trigonometry
	:	Latin - Caesar	:	Latin - Cicero and Caesar	:	Latin - Cicero
	:	Greek - Anabasis	:	Greek - Anabasis	:	Greek - Anabasis
Third Year	:	Latin - Virgil	:	Latin - Virgil	:	Latin - Virgil
	:	Latin Composition	:	Latin Composition	:	Latin Composition
	:	Greek Iliad	:	Greek Iliad	:	Greek
	:	Greek Composition	:	Greek Composition	:	Reviews
	:		:	Reviews	:	

1. Composition, Declamation and Select Reading through the course.

2. Drawing and Singing optional through the course.

APPENDIX III

LEGISLATION AFFECTING SCIENCE INSTRUCTION

Extracts from School Law of 1872

Section 50. No teacher shall be authorized to teach a common school under the provisions of this act, who is not of good moral character, and qualified to teach orthography, reading in English, penmanship, arithmetic, English grammar, modern geography, the elements of the natural sciences, the history of the United States, physiology, and the laws of health. It shall be the duty of the County Superintendent to grant certificates to such persons as may, upon due examination be found to possess the necessary qualifications. - - - - - Said certificates shall be of two grades: those of the first grade, shall be valid for two years; those of the second grade, for one year."

Extract from Amended Law of 1874

Section 50. No teacher shall be authorized to teach a common school under the provisions of this act who is not of good moral character and who does not possess a certificate as required by this section. It shall be the duty of the County Superintendent to grant certificates to such persons as may, upon due examination, be found qualified; and said certificates shall be of two grades: those of the first grade shall be valid for two years, and shall certify that the person to which such certificate is given is qualified to teach orthography, reading in English, penmanship, arithmetic, English grammar, modern geography, the elements of the natural sciences, the history of the United States,

physiology and the laws of health. Certificates of the second grade shall be valid for one year, and shall certify that the person to whom such certificate is given is qualified to teach orthography, reading in English, penmanship, arithmetic, English grammar, modern geography, and the history of the United States.

Physiology and Hygiene in Public Schools

Law of 1889

An Act relating to the study of Physiology and Hygiene in the Public Schools.

Section I. Be it enacted by the People of the State of Illinois, represented in the General Assembly: That the proper legal school authorities shall have power, and it shall be their duty, to have all pupils of suitable age in schools of Illinois, supported by public money or under state control, instructed in physiology and hygiene, with special reference to the effects of alcoholic beverages, stimulants and narcotics on the human system.

Section 2. No certificate shall be granted to any person to teach in the public schools of Illinois, after July, 1890, who has not passed a satisfactory examination in physiology and hygiene with special reference to the effects of alcoholic beverages, stimulants and narcotics on the human system.

Requiring and Regulating the Study of Physiology and Hygiene

An Act to amend "An Act relating to the study of physiology and hygiene in the public schools," approved June 1, 1889, in force July 1, 1889. Approved June 9, 1897, in force July 1, 1897.

Section I. Be it enacted by the People of the State of Illinois represented in the General Assembly: That "An act relating to the study of physiology and hygiene in the public schools," approved June 1, 1889, in force July 1, 1889, be amended so as to read as follows:

That the nature of alcoholic drinks and other narcotics and their effects on the human system shall be taught in connection with the various divisions of physiology and hygiene as thoroughly as are other branches in all schools under State control, or supported wholly or in part by public money, and also in all other schools connected with reformatory institutions.

All pupils in the above mentioned schools below the second year of the high schools and above the third year of school work computing from the beginning of the lowest primary year, or in corresponding classes of ungraded schools, shall be taught and shall study this subject every year from suitable text-books in the hands of all pupils, for not less than four lessons a week for ten or more weeks of each year, and must pass the same tests in this as in other studies.

In all schools above mentioned all pupils in the lowest three primary school years, or in corresponding classes in ungraded schools, shall each year be instructed in this subject

orally for not less than three lessons a week for ten weeks in each year, by teachers using text-books adapted for such oral instruction as a guide and standard.

The local school authorities shall provide needed facilities and definite time and place for this branch in the regular course of study.

The text-books in the pupils' hands shall be graded to the capacities of the fourth year, intermediate, grammar, and high school pupils, or to corresponding classes as found in ungraded schools.

For students below high school grade such text-books shall give at least one-fifth their space, and for students of high school grade shall give not less than twenty pages to the nature and effects of alcoholic drinks and other narcotics. The pages on this subject, in a separate chapter at the end of the book, shall not be counted in determining the minimum.

Section II. In all normal schools, teachers' training classes and teachers' institutes, adequate time and attention shall be given to instruction in the best methods of teaching this branch, and no teacher shall be licensed who has not passed a satisfactory examination in this subject and the best methods of teaching it.

Any school officer or officers who shall neglect or fail to comply with the provisions of this act shall forfeit and pay for each offense the sum of not less than five dollars nor more than twenty-five dollars. From Illinois School Law. 1899 edition.

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